Dtsch. Entomol. Z. 72 (2) 2025, 341–365 | DOI 10.3897/dez.72.153961

First report of *Lepidosira* (Collembola, Entomobryidae) from China, with description of four new species under the aid of COI barcoding

Xiaowei Qian[1], Meidong Jing[1], Yitong Ma[1]

1 *School of Life Sciences, Nantong University, Nantong, Jiangsu, 226000, China*

https://zoobank.org/E4AB50E6-895B-44FC-A994-078B3FF27271

Corresponding author: Yitong Ma (mayitong@ntu.edu.cn)

Academic editor: A. Camargo ♦ **Received** 26 March 2025 ♦ **Accepted** 16 October 2025 ♦ **Published** 5 November 2025

Abstract

In this study, species of *Lepidosira* Schött, 1925, from China are studied based on molecular markers and morphological characters. Four new species, *Lepidosira apigmenta* **sp. nov.**, *Lepidosira similis* **sp. nov.**, *Lepidosira wuxiensis* **sp. nov.**, and *Lepidosira chongqingensis* **sp. nov.**, are described, and their COI barcodes are provided. This is the first report of the genus from China. *Willowsia flava* Zhou, Pan & Ma, 2021, is transferred to *Lepidosira*, and the replacement name *Lepidosira baojiensis* **comb. et nom. nov.** is proposed since the specific epithet is preoccupied by the senior homonym *Lepidosira flava* (Salmon, 1938). The transfer of *Willowsia trifascia* Zhou & Ma, 2022 to *Lepidosira* is also herein proposed. A key to the scaled genera of the subfamily Entomobryinae is provided.

Key Words

Chaetotaxy, Chongqing, cryptic species, molecular markers, new species, springtails

Introduction

With the development of molecular biology and the discovery of new morphological characters, great changes have taken place in the classification of the family Entomobryidae in the past decade. The tribe Willowsiini was abandoned (Zhang and Deharveng 2015), and the family Entomobryidae was divided into six subfamilies, Entomobryinae, Lepidocyrtinae, Paronellidinae, Paronellinae, Salininae, and Seirinae (Godeiro et al. 2023). Among these six subfamilies, Entomobryinae is the largest, comprising 31 genera. Of these, 15 genera are devoid of scales on their body, while 16 genera possess scales. Among the scaled genera, the shape and distribution of scales are important for taxonomy at the genus level.

The genus *Lepidosira* was established by Schött in 1925, and its main characters include scales on the manubrium and dentes, dorsal chaetotaxy of the head and trunk polymacrochaetotic, a specialized microchaeta on abdominal segment I external to the m5 macrochaeta, a manubrial plate without blunt chaetae, and a bidentate mucro with a basal spine (Nunes et al. 2019). It is very close to the genus *Lepidocyrtoides* Schött, 1917, and the main difference between them is the blunt macrochaetae on the manubrium, which are absent in the former and present in the latter. *Lepidosira* is also similar to *Willowsia* Shoebotham, 1917, but scales are present on the dens in *Lepidosira* and absent in *Willowsia*.

To date, 57 species of the genus have been described worldwide (Bellinger et al. 1996–2024), and about 40 of them are from Oceania. The remaining species are from Brazil (*L. neotropicalis* Nunes & Bellini, 2019), India (*L. unguserrata* Salmon, 1970 and *L. pallida* (Ritter, 1911)), Indonesia (*L. calolepis* (Börner, 1913), *L. javana* (Börner, 1913), and *L. sundana* Yoshii & Suhardjono, 1989), Japan (*L. gigantea* (Börner, 1909)), Vietnam (*L. alba* (Nguyên, 2005) and *L. nigropunctata* (Nguyên, 2005)), and Rwanda and Burundi (*L. congoia* Salmon, 1956). The original descriptions of many of the early described species do not include body chaetotaxy and were mainly based on their color pattern. Here, we describe four new species of *Lepidosira* from Chongqing Municipality, China, representing the first report of the genus from China. Detailed descriptions of body chaetotaxy and COI sequences are provided for the new species.

Copyright *Xiaowei Qian et al.* This is an open access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Materials and methods

Survey area

Specimens were collected in the Yintiaoling National Nature Reserve, located in the northeast of Chongqing Municipality, which belongs to southwestern China. It has a subtropical humid monsoon climate with an annual average temperature of about 10 °C and an annual average precipitation of 1,500 mm. The total area of the reserve is about 22,000 hectares, and its highest point is 2,798 m above sea level (Zhang 2025).

Taxon sampling and specimen examination

Specimens were collected with an aspirator from leaf litter and stored in 99% alcohol. They were mounted on glass slides in Marc André II solution (Christiansen 1990) and studied with a Leica DM2500 phase-contrast microscope. Photographs were taken using a Leica DFC300 FX digital camera mounted on the microscope and enhanced with Photoshop CS2 (Adobe Inc.). Type specimens were deposited in the School of Life Sciences, Nantong University, Jiangsu, China.

The nomenclature of the dorsal macrochaetotaxy of the head and interocular chaetae follows Jordana and Baquero (2005) and Mari-Mutt (1979, 1986). Labial chaetae are designated following Gisin (1964). Labral chaetae follow Szeptycki (1973), and trunk dorsal chaetotaxy follows Szeptycki (1979), adapted from Zhang et al. (2019).

Abbreviations

Ant. antennal segment(s),
Th. thoracic segment(s),
Abd. abdominal segment(s),
mac macrochaeta(e),
mes mesochaeta(e),
ms specialized microchaeta(e),
sens specialized ordinary chaeta(e),
Gr. group.

DNA extraction and amplification

DNA was extracted using an Ezup Column Animal Genomic DNA Purification Kit (Sangon Biotech, Shanghai, China) following the manufacturer's standard protocols. Amplification of a 658 bp fragment of the mitochondrial COI gene was carried out using a Prime Thermal Cycler (TECHNE, Bibby Scientific Limited, Stone, Staffordshire, UK) in 25 µl reaction volumes with the Premix Taq polymerase system (Takara Bio, Otsu, Shiga, Japan). The primers and polymerase chain reaction (PCR) programs followed Greenslade et al. (2011). All PCR products were checked using 1% agarose gel electrophoresis. Successful products were purified and sequenced on an ABI 3730XL DNA Analyzer (Applied Biosystems, Foster City, CA, USA). All experiments were completed by Shenggong (Shanghai, China). The GenBank accession numbers are provided in Table 1.

DNA sequences were assembled using Sequencher 4.5 (Gene Codes Corp.) and then deposited in GenBank. Sequences were aligned using ClustalW implemented in MEGA 5.1 (Tamura et al. 2011) with default settings. Pairwise genetic distances were calculated in MEGA 5.1 employing the Kimura 2-parameter (K2-P) model (Kimura 1980). The neighbor-joining tree was constructed in MEGA 5.1 using the neighbor-joining algorithm (Fig. 1).

Table 1. Included species and their respective GenBank accession numbers.

Species	Voucher	GenBank	Data
Lepidosira apigmenta sp. nov.	M1311-8	PV282589	This study
	M1321-14	PV282590	
	M1321-13	PV282591	
	M1321-12	PV282592	
L. similis sp. nov.	M1311-7	PV282594	This study
L. wuxiensis sp. nov.	M1321-9	PV282586	This study
	M1321-10	PV282587	
	M1321-11	PV282588	
L. chongqingensis sp. nov.	M1311-4	PV282593	This study
L. baojiensis comb. et nom. nov.	1102-3	PV282595	This study
L. calolepis (Börner, 1913)		OP094719	GenBank
L. neotropicalis Nunes & Bellini, 2019		MF716603	Personal communication*

* Sequence obtained directly from the authors.

Results

Molecular analysis

In the present study, the shortest interspecific distances were 13.9–15.6% (between *L. apigmenta* sp. nov. and *L. wuxiensis* sp. nov.) and the longest were 23.8–25.0% (between *L. wuxiensis* sp. nov. and *L. calolepis*) (Table 2). Therefore, the interspecific distances of COI among the seven species were greater than the accepted barcoding gap recently reported for species of *Tomocerus* (Zhang et al. 2014) and *Coecobrya* (Zhang et al. 2018). The molecular distances coincided with the morphological divergences, thus further supporting the separation of the four new species.

Taxonomy

Class Collembola Lubbock, 1870
Order Entomobryomorpha Börner, 1913
Family Entomobryidae Tömösvary, 1882
Subfamily Entomobryinae Schäffer, 1896

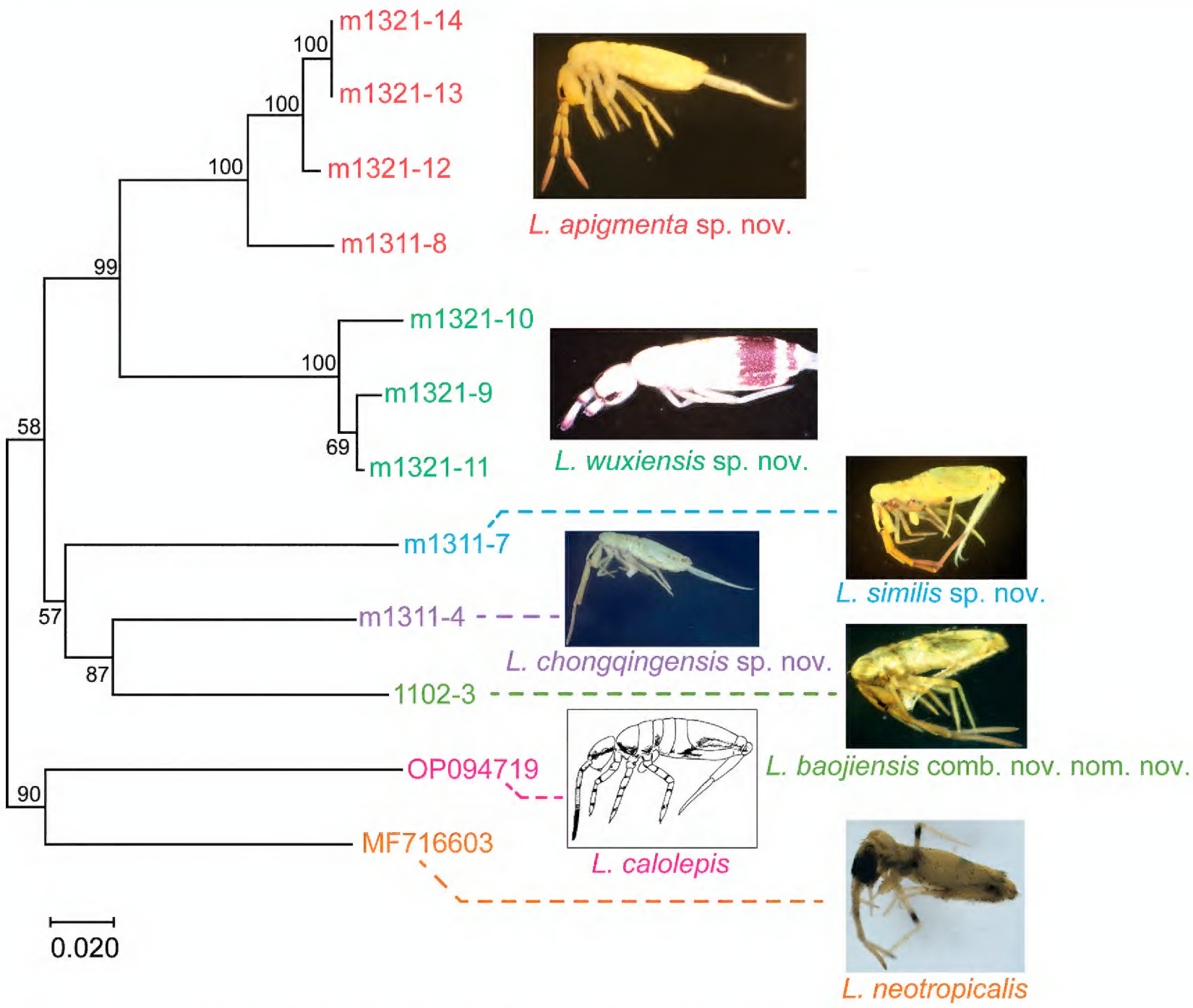

Figure 1. Neighbor joining tree (using K2-P model) of seven *Lepidosira* species based on COI sequences.

Table 2. Genetic distances (mean K2-P divergence) between *Lepidosira* species in this study.

Species	*L. apigmenta* sp. nov.	*L. wuxiensis* sp. nov.	*L. similis* sp. nov.	*L. chongqingensis* sp. nov.	*L. baojiensis* nom. nov.	*L. calolepis* (Börner, 1913)	*L. neotropicalis* Nunes & Bellini, 2019
***L. apigmenta* sp. nov.**							
***L. wuxiensis* sp. nov.**	13.9–15.6						
***L. similis* sp. nov.**	19.8–20.3	21.3–22.5					
***L. chongqingensis* sp. nov.**	18.5–19.0	20.0–21.2	19.7				
***L. baojiensis* nom. nov.**	19.5–20.0	21.0–22.2	20.7	16.4			
***L. calolepis* (Börner, 1913)**	22.3–22.8	23.8–25.0	24.9	23.6	24.6		
***L. neotropicalis* Nunes & Bellini, 2019**	20.7–21.2	22.2–23.4	23.3	22.0	23.0	21.0	

Key to the scaled genera of the subfamily Entomobryinae

Based mainly on Bellinger et al. (1996–2024).

1 Abd. VI with finger-like projection ..... *Epimetrura*
– Abd. VI without finger-like projection 2
2 Scales present on dens 3
– Scales absent on dens 7
3 Dental spines present ..... *Acanthocyrtus*
– Dental spines absent 4
4 Basal ribs of scales longer than distal ones ..... *Lepidodens*
– Basal ribs of scales almost as long as distal ones 5
5 Scales narrow and tip pointed ..... *Lepidobrya*
– Scales not narrow and tip not pointed 6

6	Manubrium with distal thick blunt macrochaetae	*Lepidocyrtoides*
–	Manubrium without distal thick blunt macrochaetae	*Lepidosira*
7	Dental spines present	8
–	Dental spines absent	9
8	Prelabral bifurcate	*Amazhomidia*
–	Prelabral not bifurcate	*Sinhomidia*
9	Eyes absent	10
–	Eyes present	12
10	Mucro bidentate	*Szeptyckiella*
–	Mucro falcate	11
11	Body macrochaetae well developed	*Hawinella*
–	Body macrochaetae strongly reduced	*Lepidosinella*
12	Mucro falcate	13
–	Mucro bidentate	14
13	Mucronal basal spine absent	*Desertia*
–	Mucronal basal spine present	*Drepanosira*
14	Scales chaeta-like and scales of posterior row of tergites strongly elongate	*Janetschekbrya*
–	Scales not chaeta-like and scales of posterior row of tergites not strongly elongate	15
15	Scales narrow and with 2 uninterrupted lateral ribs	*Americabrya*
–	Scales of different types, but always with internal cilia	*Willowsia*

Genus *Lepidosira* Schött, 1925

Type species. *Lepidosira terraereginae* (Ellis & Bellinger, 1973: 28), by subsequent designation.

Diagnosis. Scales ciliate and present on the body, including manubrium and dentes; dorsal chaetotaxy of head and trunk polymacrochaetotic; ms on Abd. I external to m5; manubrial plate without blunt chaetae; a bidentate mucro with a basal spine (Nunes et al. 2019).

Lepidosira apigmenta sp. nov.

https://zoobank.org/C78B645B-EAC3-4FB6-ACF9-94F668405948

Figs 2–7, Table 3

Type material. ***Holotype.*** CHINA • ♀ on slide; Chongqing Municipality, Wuxi County, the Yintiaoling National Nature Reserve, the Guanshan Protection Station, the Stone Pillar; 2,168.92 m a.s.l.; 31°32'15"N, 109°41'54"E; 28 Jul. 2024; Y.T. Ma leg.; sample number 1321 (CQWX0717).

Paratypes. CHINA • 3 ♀ on slides, same data as holotype.

Diagnosis. Each segment of Ant. I–III distally violet pigmented; Ant. IV and base of Ant. I with scattered violet pigment; Ant. IV with bilobed apical bulb; head with one mac on Gr. II; Th. II with one medio-medial, two medio-sublateral and 15–16 posterior mac; Th. III to Abd. IV respectively with 10, 4, 4, 2, and 9–11 central mac; Abd. III with four lateral mac.

Description. Body (head + trunk) length up to 1.92 mm, holotype 1.92 mm.

***Color pattern*:** ground color pale yellow; eye patches dark blue; each segment of Ant. I–III distally violet pigmented, Ant. IV and base of Ant. I with scattered violet pigment; a little violet pigment present in post-ocular region and on legs (Fig. 2A, B).

Figure 2. *Lepidosira apigmenta* sp. nov. **A**, **B.** Habitus (lateral view). Scale bars: 500 µm.

***Scales*:** ciliate type, present on head, Ant. I–II, legs (Fig. 3A), both faces of ventral tube, ventral side of manubrium and dentes (Fig. 3B, C), and terga (Figs 3D, 4A).

***Head*:** antenna not annulated and 0.45–0.56 (holotype 0.50) times length of body. Ratio of Ant. I–IV as 1.00/1.35–1.82/1.20–1.67/2.25–3.00 (holotype 1.00/1.78/1.65/2.67). Distal part of Ant. IV with many sensory chaetae and normal ciliate chaetae, apical bulb

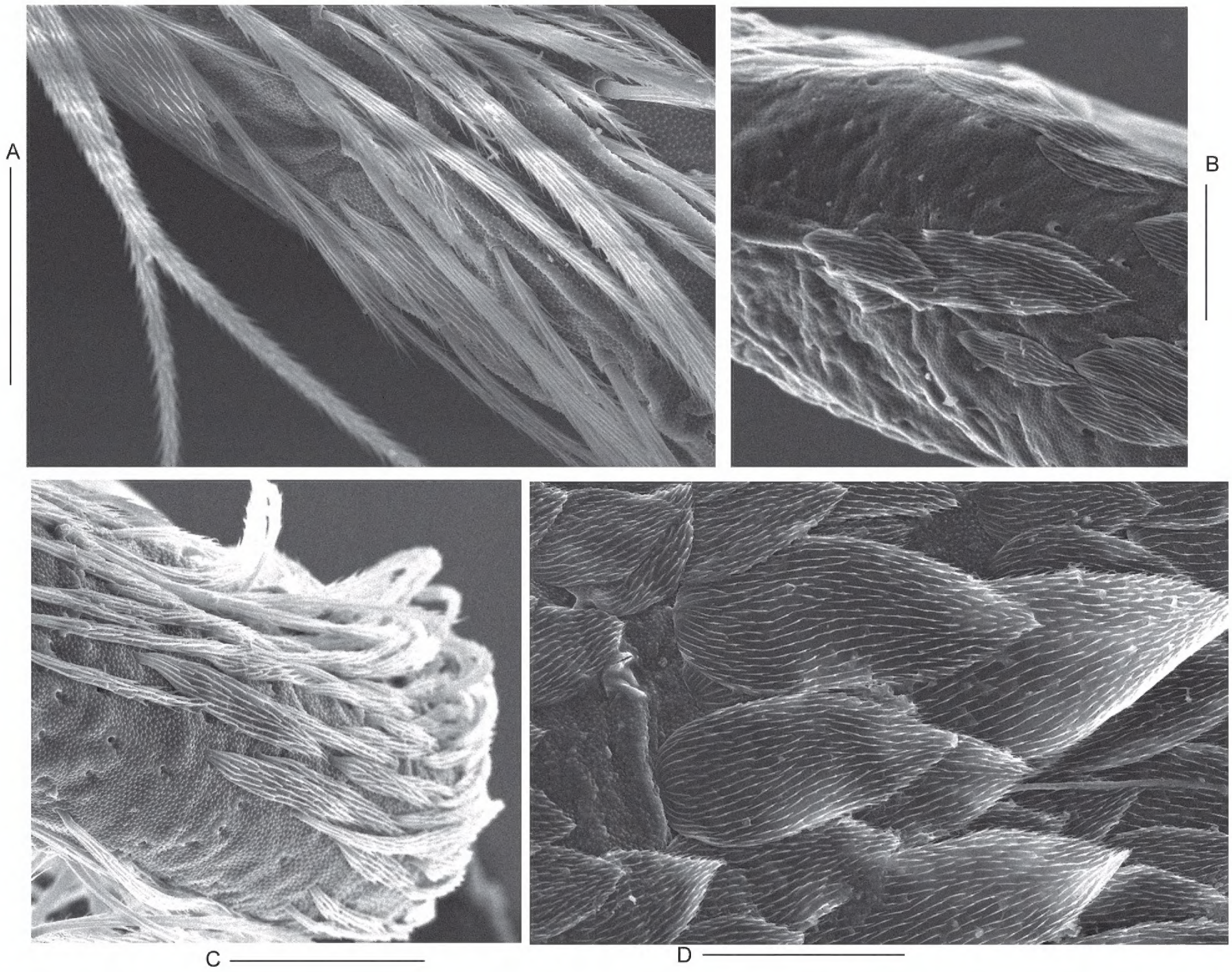

Figure 3. SEM photomicrographs of scales of *Lepidosira apigmenta* sp. nov. **A.** Leg; **B.** Manubrium; **C.** Dens; **D.** Trunk. Scale bars: 20 μm.

bilobed (Fig. 4B). Ant. III sense organ with two rods, two spiny guard sensilla, smooth blunt sens, and ciliated chaetae (Fig. 4C). Ant. II with two rods apically (Fig. 4D). Eyes 8+8, G and H smaller than others, interocular chaetae as p, q, r, s, t mes, and r absent in one specimen. Dorsal chaetotaxy of head with 10–14 antennal (An) mac or mes, four anterior (A0, A2, A3, A5), four median (M1–4), eight sutural (S0–7) mac, one post-sutural mac (Ps2) and mes (Ps5), 12 posterior mac plus one (Pa1) in Gr. II (Fig. 4E). Prelabral and labral chaetae as 4/5, 5, 4, prelabral chaetae ciliate and other smooth, a2 and b2 slightly shorter than middle ones, labral papillae not clearly seen (Fig. 4F). Basal chaeta on maxillary outer lobe almost as thick as apical one; sublobal plate with four smooth chaetae-like processes (Fig. 4G). Lateral process (l. p.) of labial palp E finger-shaped with tip not or almost reaching apex of papilla E (Fig. 4H). Labial base with $M_1M_2REL_1L_2$, all ciliate (Fig. 4I).

***Thorax*:** tergal ms formula on Th. II–Abd. V as 1, 0/1, 0, 1, 0, 0, sens as 2, 2/1, 2, 2, 2, 3 (Figs 5A, 6A–C). Th. II with about ten anterior, one medio-medial (m1), two medio-sublateral (m4, m4i), 15–16 posterior mac. Th. III with ten central and six lateral mac (Fig. 5A). Coxal chaetal formula as 7–10/8–11 (anterior), 9–12 (posterior)/9–14 (Fig. 5B–D). Trochanteral organ with 36–46 smooth chaetae (Fig. 5E). Tenent hair smooth and clavate, 1.27–1.30 length of inner edge of unguis; unguis with a pair of laterobasal outer teeth and four inner teeth, basal paired inner teeth located at 0.38–0.43 distance from base of inner edge of unguis, distal unpaired inner teeth at 0.67–0.70 and 0.84–0.85 distance from base, respectively; unguiculus lanceolate, outer edge slightly serrate (Fig. 5F).

***Abdomen*:** range of Abd. IV length as 4.77–5.50 (holotype 5.50) times as dorsal axial length of Abd. III. Abd. I with four (m2–4, m4i) mac. Abd. II with four (a2, m3, m3e, m3ep) central, one (m5) lateral mac. Abd. III with two (a2, m3) central, four (am6, pm6, m7a, p6) lateral mac (Fig. 6A). Abd. IV with two normal sens, 9–11 central and about 13 lateral mac (Fig. 6B). Abd. V with three sens (Fig. 6C). Anterior face of ventral tube with 3+3 large and about 13 small ciliate chaetae, line connecting proximal (Pr) and external-distal (Ed) mac oblique to median furrow (Fig. 6D); posterior face with two apical smooth chaetae besides about 60 ciliate chaetae of different sizes (Fig. 7A); each lateral flap with 5–6 smooth and 9–10 ciliate chaetae (Fig. 7B). Manubrial plate dorsally with 12–17 ciliate mac and 3–4 pseudopores (Fig. 7C); ventrally

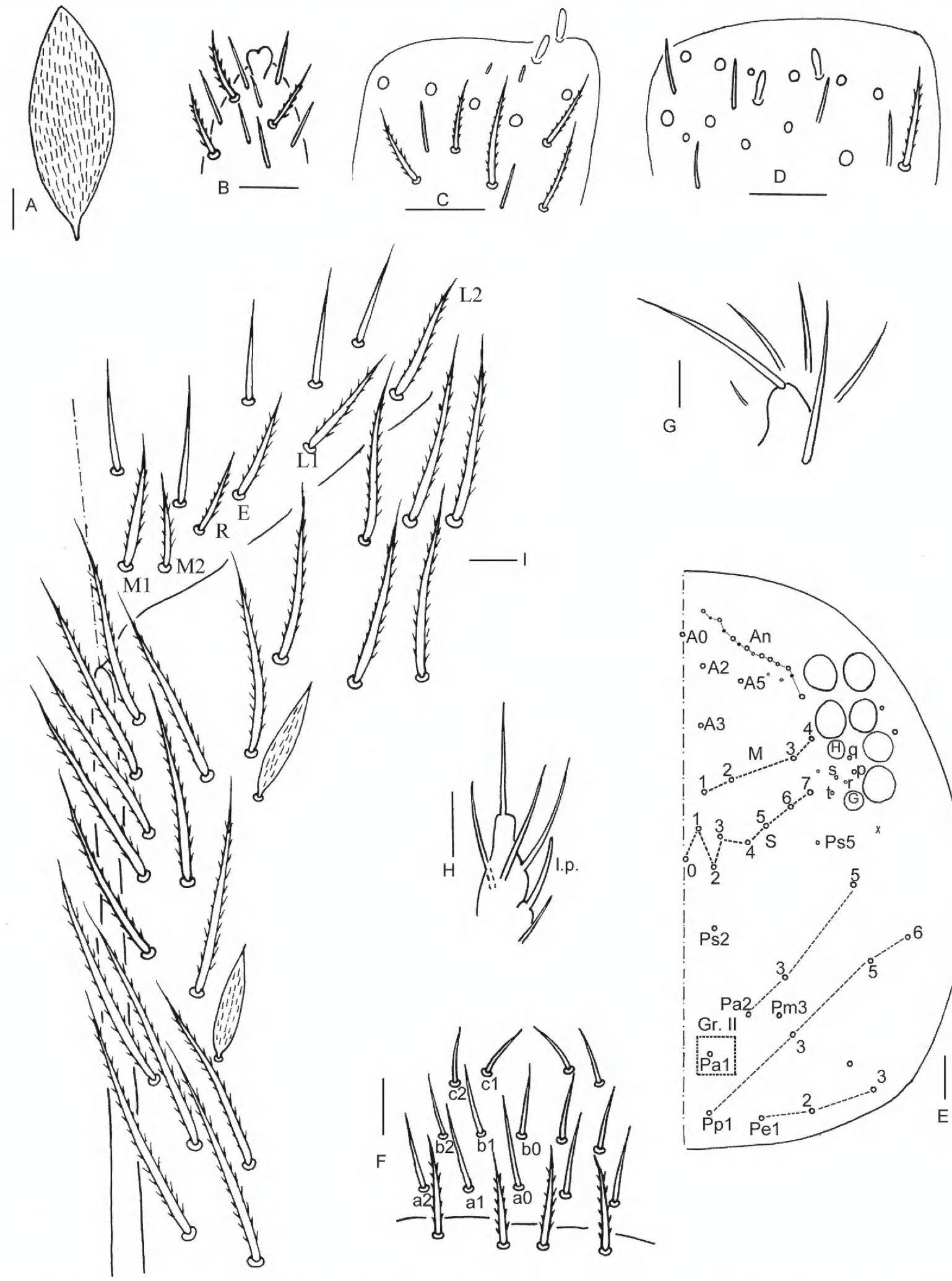

Figure 4. *Lepidosira apigmenta* sp. nov. **A.** Scale on dorsal trunk; **B.** Apex of Ant. IV (dorsal view); **C.** Distal Ant. III (lateral view); **D.** Distal Ant. II (dorsal view); **E.** Dorsal head (right side, solid circle representing mac present or absent); **F.** Prelabral and labral chaetotaxy (dorsal view); **G.** Maxillary palp and outer lobe (right side); **H.** Labial palp (right side); **I.** Labial and post-labial chaetotaxy (right side). Scale bars: 20 μm.

with 21–28 ciliate chaetae on each side (Fig. 7D). Mucro bidentate; tip of basal spine reaching apex of subapical tooth; distal smooth section of dens almost equal to mucro in length (Fig. 7E).

Etymology. The name is composed of the Greek word "*a*," meaning absence, and the Latin word "*pigmentum*," meaning color. Thus, "*apigmenta*" refers to the unpigmented trunk.

Habitat. Found in litter of subtropical forests, mainly composed of leaves of *Buxus sinica*, *Ilex yunnanensis*, *Pinus armandii* and *Rosa corymbulosa*.

Remarks. According to Fig. 1 and Table 3, the new species is close to *Lepidosira wuxiensis* sp. nov. Their antennal color pattern and the chaetotaxy of the dorsal head, Th. II, Abd. I, and Abd. III–IV are also very similar. However, the color pattern of Abd. IV and the chaetotaxy of Th. III and Abd. II are different. The new species is also similar to the Vietnamese species *L. alba* (Nguyên, 2005) in color pattern, but labral papillae and smooth setae on the posterior face of the ventral tube are present in the former and absent in the latter. The main differences among the three species in chaetotaxy are listed in Table 3.

Table 3. Variation of dorsal chaetotaxy of *Lepidosira* species from Asia and South America (? = not known).

Species	Species number	Head		Th. II			Th. III		Abd. I	Central Abd. II	Abd. III		Abd. IV	
		An	interocular setae	Gr. II	Mm	posterior	central	lateral			central	lateral	central	lateral
L. apigmenta	1321–11	11	pqrst	1	1	15	10	6	4	4	2	4	10	11+13
sp. nov.	1321–12	14	pqrst	1	1	15	10	6	4	4	2	4	11	?
	1321–13A	10+11	pqrst	1	1	16	9+10	6	4	4	2	4	11	?
	1321–13B	?	pqrst	1	1	15	10	6	4	4	2	4	9	16
L. similis sp. nov.	1306–27	8	pvt	1	3	15	11	6	3	5	3	5	16+18	20
	1306–40A	?	?	1	?	17	11	6	3	5	3	5	15	17+18
	1306–40B	8	pvt	1	3	17	11	6	3	5	3	5	16+18	22
	1306–40C	9	pvt	1	3	17	11	6	3	5	3	5	18+19	?
L. wuxiensis	1321–6A	?	pqrst	?	1	10	8	6	4	3	2	4	8+9	13
sp. nov.	1321–6B	7	pqrst	1	1	12	8	6	4	3	2	4	8	16
	1321–14	9	pqrst	1	1	11+12	8	6	?	?	2	?	8	?
	1321–15	7+9	?	1	1	12	8	6	4	3	2	4	9	15
L. chongqingensis	1311–1A	8+9	pvt	3	3	18	12	7	4	6	2–3	5	19+23	20
sp. nov.	1311–1B	8	pvt	3	3	17+18	12	7	4	6	3	5	18+20	?
	1311–1C	9	pvt	3	2+3	18	12	7	4	6	3	5	17+20	18
	1311–1D	11	pvt	3	3	19	12	7	4	6	3	5	22+25	20
L. baojiensis nom. nov.		9	pvt	3	3	22–23	12–13	7	7	6	3	5	16–20	21–22
L. trifascia		8–12	pvt	3	3	25–27	16	8	7	6	3	5	16–20	18–22
L. alba		?	?	?	2	?	9	?	2	5	3	4	?	?
*L. calolepis**		7	?	0	3	7	4	?	0	3	1	0	0	0
*L. gigantea***		?	?	?	3	10	9	?	2	3	3	?	?	?
*L. javana**		9	?	0	3	9	6	?	0	3	1	?	?	?
L. neotropicalis		8–10	pqrst	0	2	16–17	8	6–7	6	6	2	3	?	?
L. nigropunctata		?	?	?	2	15	20	?	8	4	2	?	13	?
L. sundana		7	?	0	3	16	20	?	5	5	3	?	?	?
L. pallida		?	?	?	?	?	?	?	?	?	?	?	?	?
L. unguserrata		?	?	?	?	?	?	?	?	?	?	?	?	?

* based on Yoshii and Suhardjono (1989); **based on Yoshii (1992).

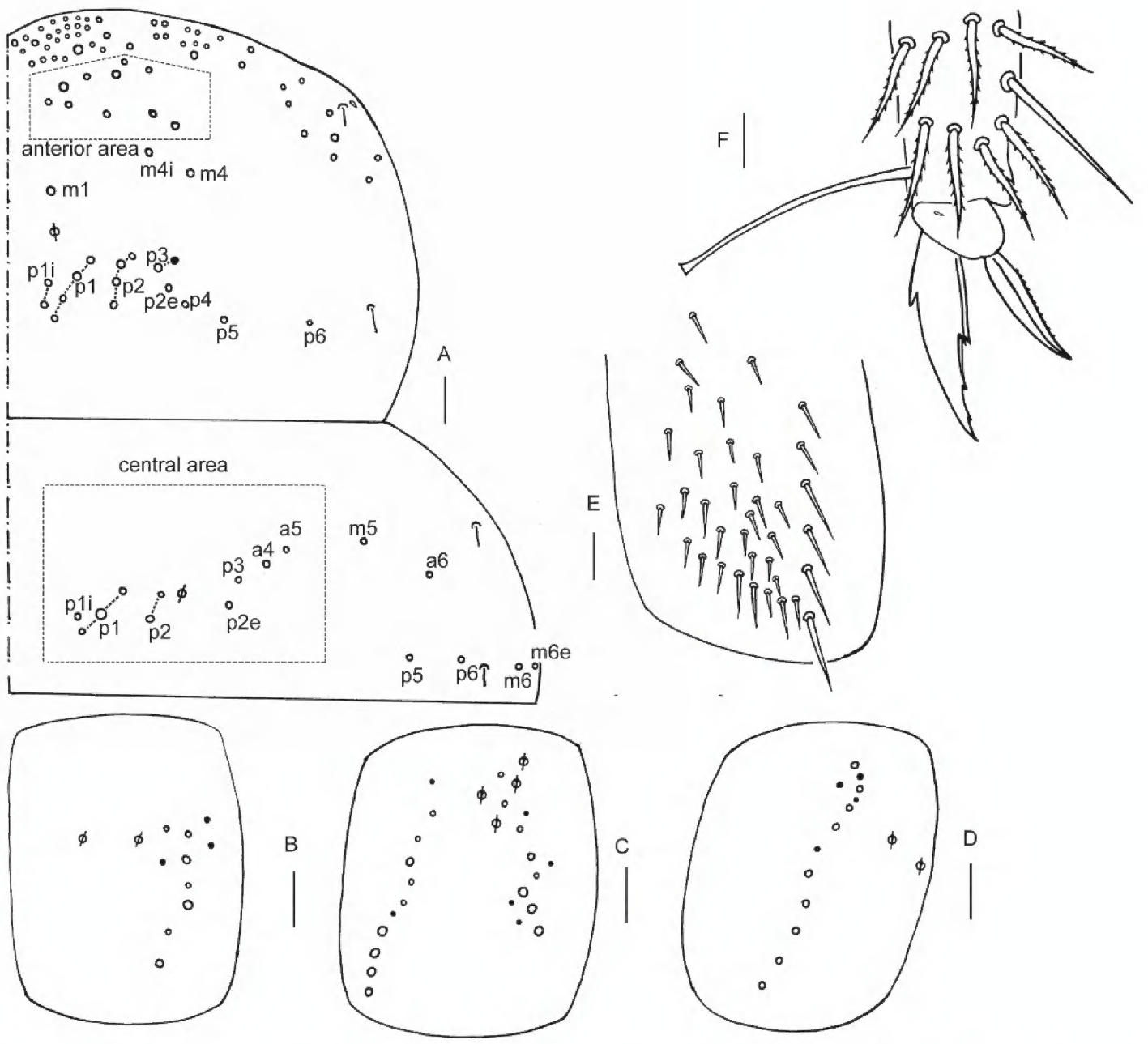

Figure 5. *Lepidosira apigmenta* sp. nov. **A.** Chaetotaxy of Th. II–III (right side); **B–D.** Coxal chaetotaxy of fore, middle, and hind legs (outer view); **E.** Trochanteral organ (posterior side); **F.** Hind foot complex (lateral view). Scale bars: 20 µm.

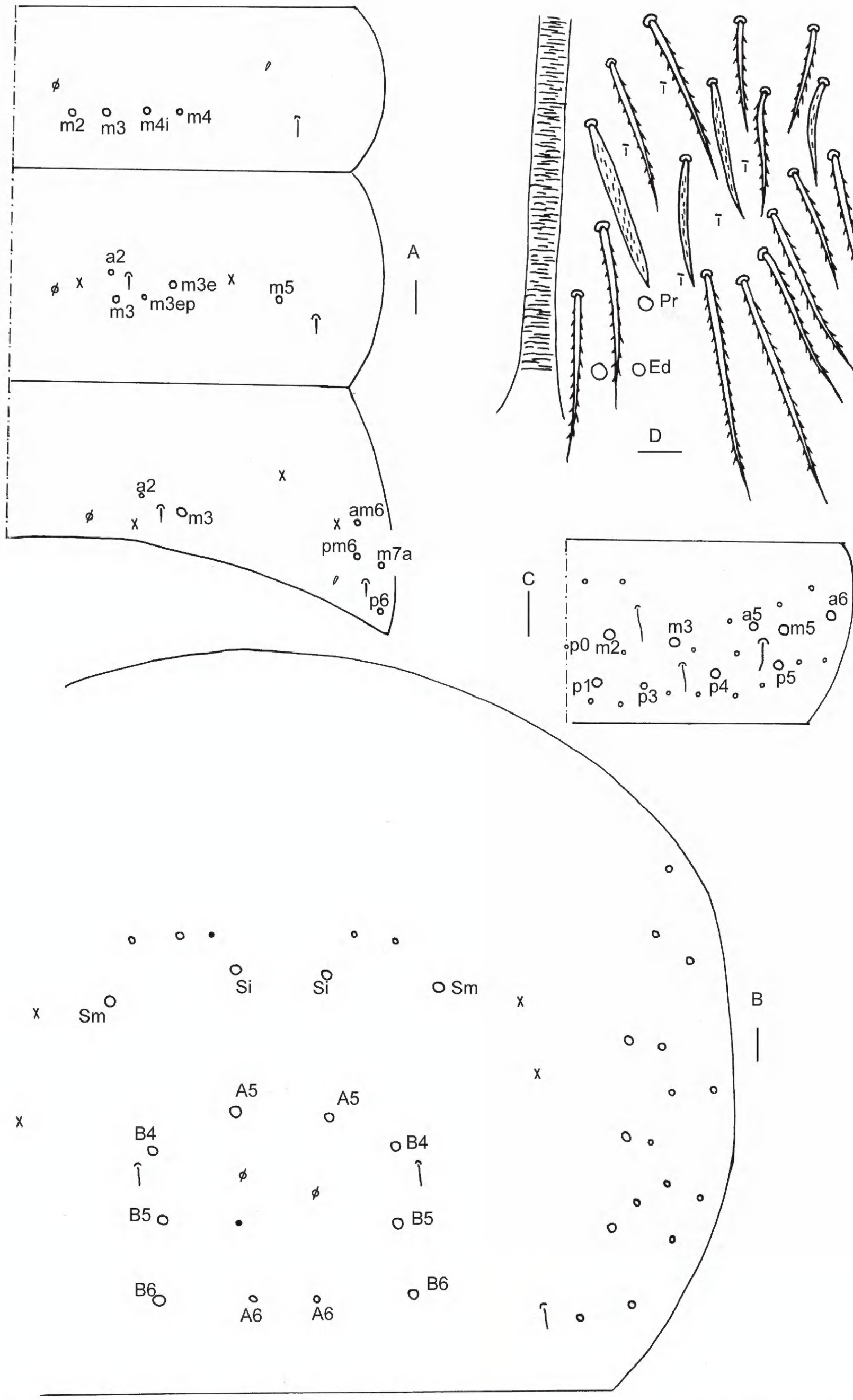

Figure 6. *Lepidosira apigmenta* sp. nov. **A.** Chaetotaxy of Abd. I–III (right side); **B.** Chaetotaxy of Abd. IV (right side and partially left side); **C.** Chaetotaxy of Abd. V (right side); **D.** Anterior face of ventral tube (T-shape representing scale). Scale bars: 20 μm.

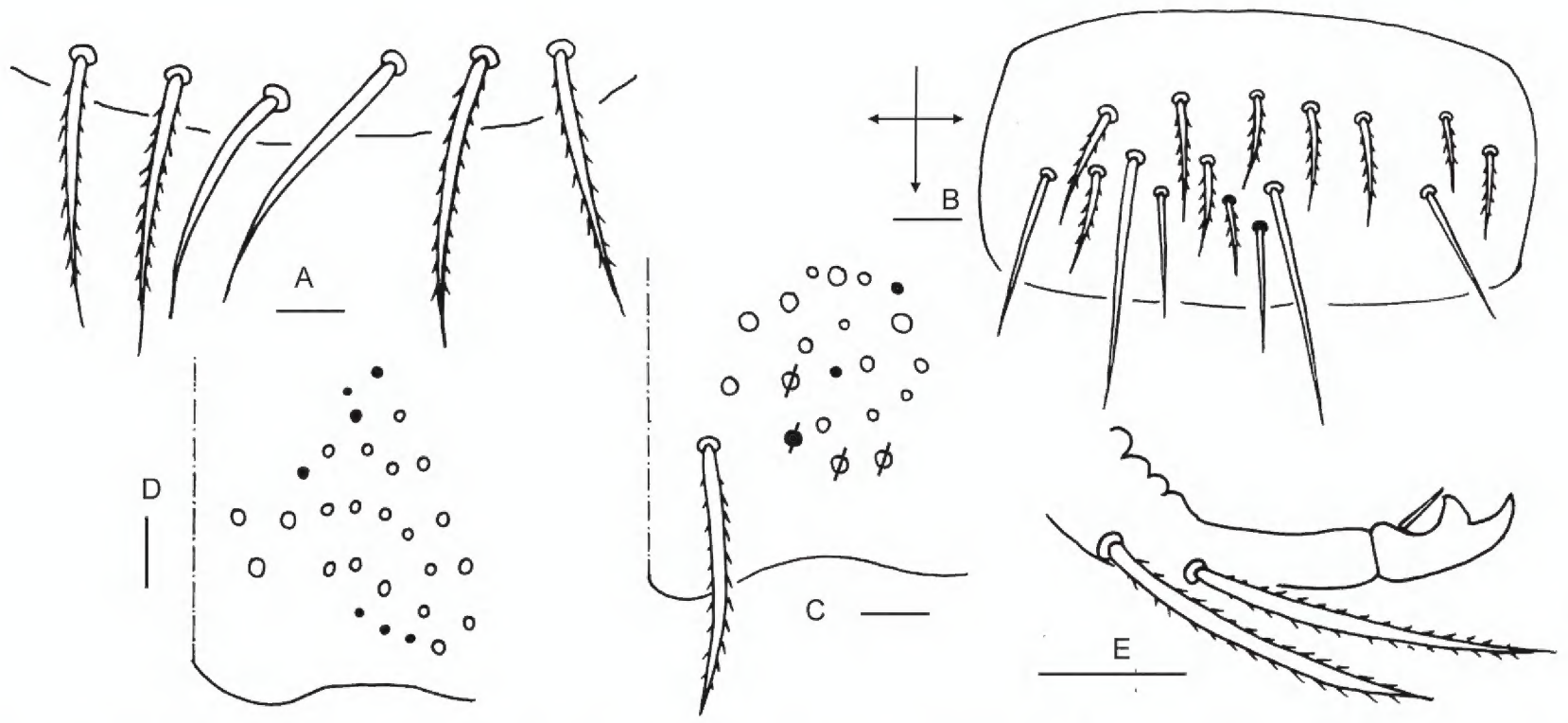

Figure 7. *Lepidosira apigmenta* sp. nov. **A.** Apical chaetae of posterior face of ventral tube; **B.** Lateral flap of ventral tube; **C.** Manubrial plaque (dorsal view); **D.** Ventro–apical part of manubrium; **E.** Distal part of dens and mucro (lateral view). Scale bars: 20 μm.

Lepidosira similis sp. nov.

https://zoobank.org/7685D6DC-F92A-4A00-9CE5-25AD80C65116

Figs 8–13, Table 3

Type material. ***Holotype.*** CHINA • ♀ on slide; Chongqing Municipality, Wuxi County, the Yintiaoling National Nature Reserve, the Hongqi Protection Station; 1,129.10 m a.s.l.; 31°30'33"N, 109°49'10"E; 21 Jul. 2024; Y.T. Ma leg.; sample number 1306 (CQWX0701).

Paratypes. CHINA • 2 ♀ on slides, same data as holotype.

Diagnosis. Violet pigment present on Ant. III–IV and post-ocular region; coxae and distal part of femora of mid and hind legs with a little violet pigment; Ant. IV with bilobed apical bulb; head with one mac on Gr. II; Th. II with three medio-medial, one medio-sublateral and 17 posterior mac; Th. III to Abd. IV respectively with 11, 3, 5, 3, and 15–19 central mac; Abd. III with five lateral mac.

Description. Body (head + trunk) length up to 2.45 mm, holotype 2.24 mm.

***Color pattern*:** ground color pale yellow; eye patches dark blue; violet pigment present on Ant. III–IV and post-ocular region; coxae and distal part of femora of mid and hind legs with a little violet pigment (Fig. 8A, B).

***Scales*:** ciliate type, present on Ant. I–II (Fig. 9A), basal Ant. III, legs (Fig. 9B), both faces of ventral tube, ventral side of manubrium and dentes (Fig. 9C, D), head, and terga (Figs 9E, 10A).

***Head*:** antenna not annulated and 0.62–0.71 (holotype 0.65) times length of body, Ratio of Ant. I–IV as 1.00/1.57–1.67/1.33–1.42/2.62–2.75 (holotype 1.00/1.57/1.41/2.65). Distal part of Ant. IV with many sensory chaetae and normal ciliate chaetae, apical bulb bilobed (Fig. 10B). Ant. III sense organ with two rods, two spiny guard sensilla, smooth blunt sens, and ciliated chaetae (Fig. 10C). Ant. II with 2–3 rods apically

Figure 8. *Lepidosira similis* sp. nov. **A, B.** Habitus (lateral view). Scale bars: 500 μm.

(Fig. 10D). Eyes 8+8, G and H smaller than others, interocular chaetae as p, r, t mes. Dorsal chaetotaxy of head with 8–9 antennal (An), four anterior (A0, A2, A3, A5), four median (M1–4), seven sutural (S0–3, S5–7) mac, one post-sutural mac (Ps2) and mes (Ps5), 12 posterior mac plus one (Pa1) in Gr. II (Fig. 10E). Prelabral and labral chaetae as 4/5, 5, 4, prelabral chaetae ciliate and other smooth, a2 and b2 slightly shorter than middle ones, labral papillae conical (Fig. 10F).

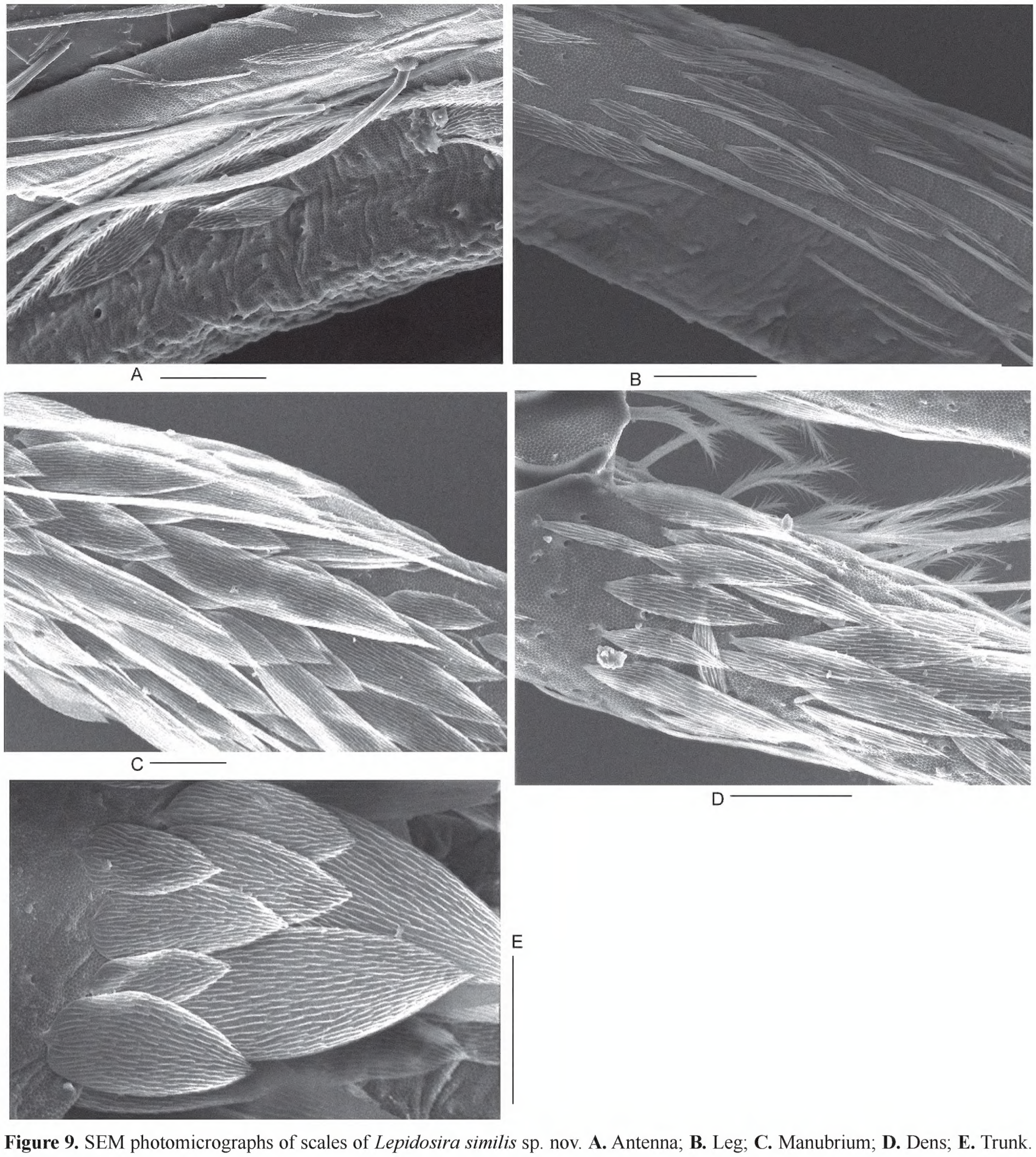

Figure 9. SEM photomicrographs of scales of *Lepidosira similis* sp. nov. **A.** Antenna; **B.** Leg; **C.** Manubrium; **D.** Dens; **E.** Trunk. Scale bars: 20 μm.

Basal chaeta on maxillary outer lobe almost as thick as apical one; sublobal plate with four smooth chaetae-like processes (Fig. 10G). Lateral process (l. p.) of labial palp E finger-shaped with tip not reaching apex of papilla E (Fig. 10H). Labial base with $M_1M_2REL_1L_2$, all ciliate (Fig. 10I).

***Thorax*:** tergal ms formula on Th. II–Abd. V as 1, 0/1, 0, 1, 0, 0, sens as 2, 2/1, 2, 2, 2, 3 (Figs 11A, 12A–C). Th. II with 10–12 anterior, three medio-medial (m1, m2, m2i), one medio-sublateral (m4), 17 (rarely 15) posterior mac. Th. III with 11 central and six lateral mac (Fig. 11A). Coxal chaetal formula as 3–5/10–14 (anterior), 3–9 (posterior)/17–23 (Fig. 11B–D). Trochanteral organ with 75–103 smooth chaetae (Fig. 11E). Tenent hair smooth and clavate, 1.21–1.39 length of inner edge of unguis; unguis with a pair of laterobasal outer teeth and four inner teeth, basal pair inner teeth located at 0.42–0.45 distance from base of inner edge of unguis, distal unpaired inner teeth at 0.69–0.73 and 0.87–0.88 distance from base, respectively; unguiculus lanceolate, outer edge slightly serrate (Fig. 11F).

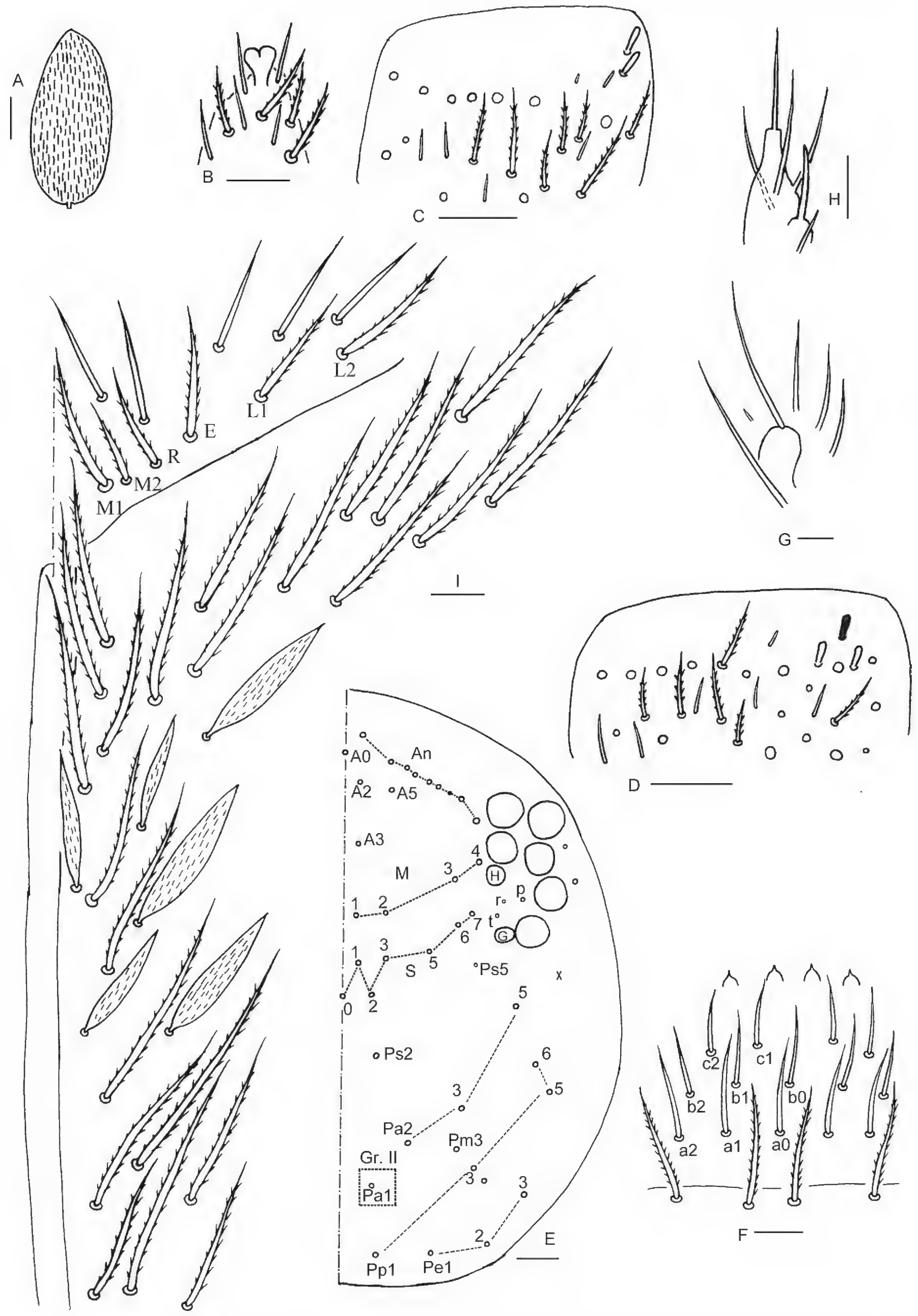

Figure 10. *Lepidosira similis* sp. nov. **A.** Scale on trunk; **B.** Apex of Ant. IV (dorsal view); **C.** Distal Ant. III (lateral view); **D.** Distal Ant. II (dorsal view); **E.** Dorsal head (right side); **F.** Prelabral and labral chaetotaxy (dorsal view); **G.** Maxillary palp and outer lobe (right side); **H.** Labial palp (right side); **I.** Labial and post-labial chaetotaxy (right side). Scale bars: 20 µm.

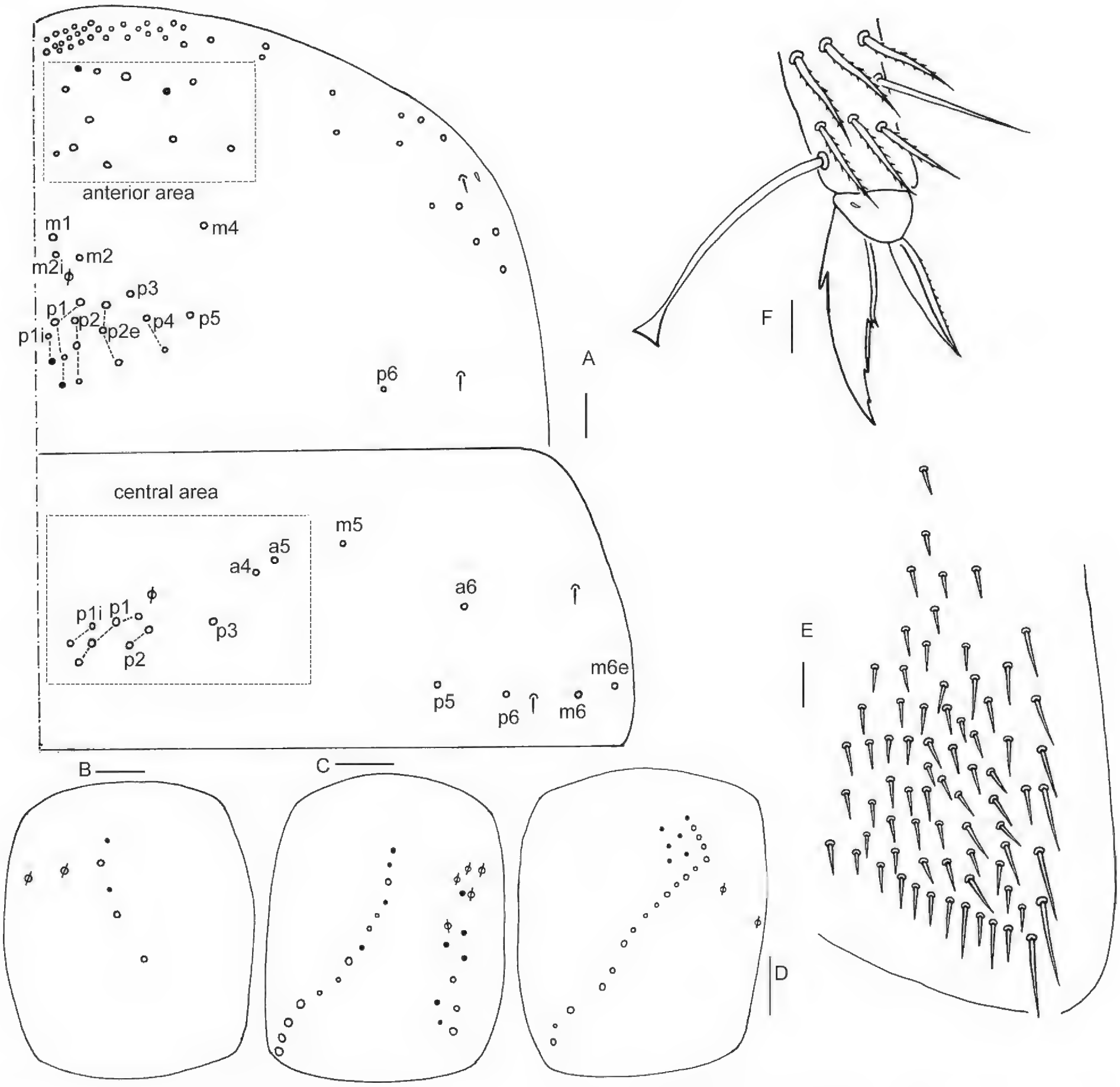

Figure 11. *Lepidosira similis* sp. nov. **A.** Chaetotaxy of Th. II–III (right side); **B–D.** Coxal chaetotaxy of fore, middle, and hind legs (outer view); **E.** Trochanteral organ (posterior side); **F.** Hind foot complex (lateral view). Scale bars: 20 μm.

***Abdomen*:** range of Abd. IV length as 5.38–7.72 (holotype 7.11) times as dorsal axial length of Abd. III. Abd. I with three (m2–4) mac. Abd. II with five (a2, a3, m3, m3e, m3ep) central, one (m5) lateral mac. Abd. III with three (a2, a3, m3) central, five (am6, pm6, m7a, p6, p7) lateral mac (Fig. 12A). Abd. IV with two normal sens, 15–19 central, 17–22 lateral mac (Fig. 12B). Abd. V with three sens (Fig. 12C). Anterior face of ventral tube with 3+3 large and about one small ciliate chaeta, line connecting proximal (Pr) and external-distal (Ed) mac oblique to median furrow (Fig. 12D); posterior face with two apical smooth chaetae besides about 30 ciliate chaetae of different sizes (Fig. 13A); each lateral flap with 6–8 smooth and about 19 ciliate chaetae (Fig. 13B). Manubrial plate dorsally with 13–18 ciliate mac and 3–4 pseudopores (Fig. 13C); ventrally with 23–33 ciliate chaetae (Fig. 13D). Mucro bidentate; tip of basal spine reaching apex of subapical tooth; distal smooth section of dens almost equal to mucro in length (Fig. 13E).

Etymology. The Latin adjective word "*similis*," meaning similar, refers to its similarity with *L. chongqingensis* sp. nov.

Habitat. Found in litter of subtropical forests, mainly composed of leaves of *Buxus sinica*, *Dendrobenthamia japonica* var. *chinensis*, *Ilex yunnanensis*, *Rosa corymbulosa*, and *Viburnum betulifolium*.

Remarks. This new species is very similar to *L. chongqingensis* sp. nov. and *L. baojiensis* nom. nov. in color pattern, and their chaetotaxy of Th. II–III and

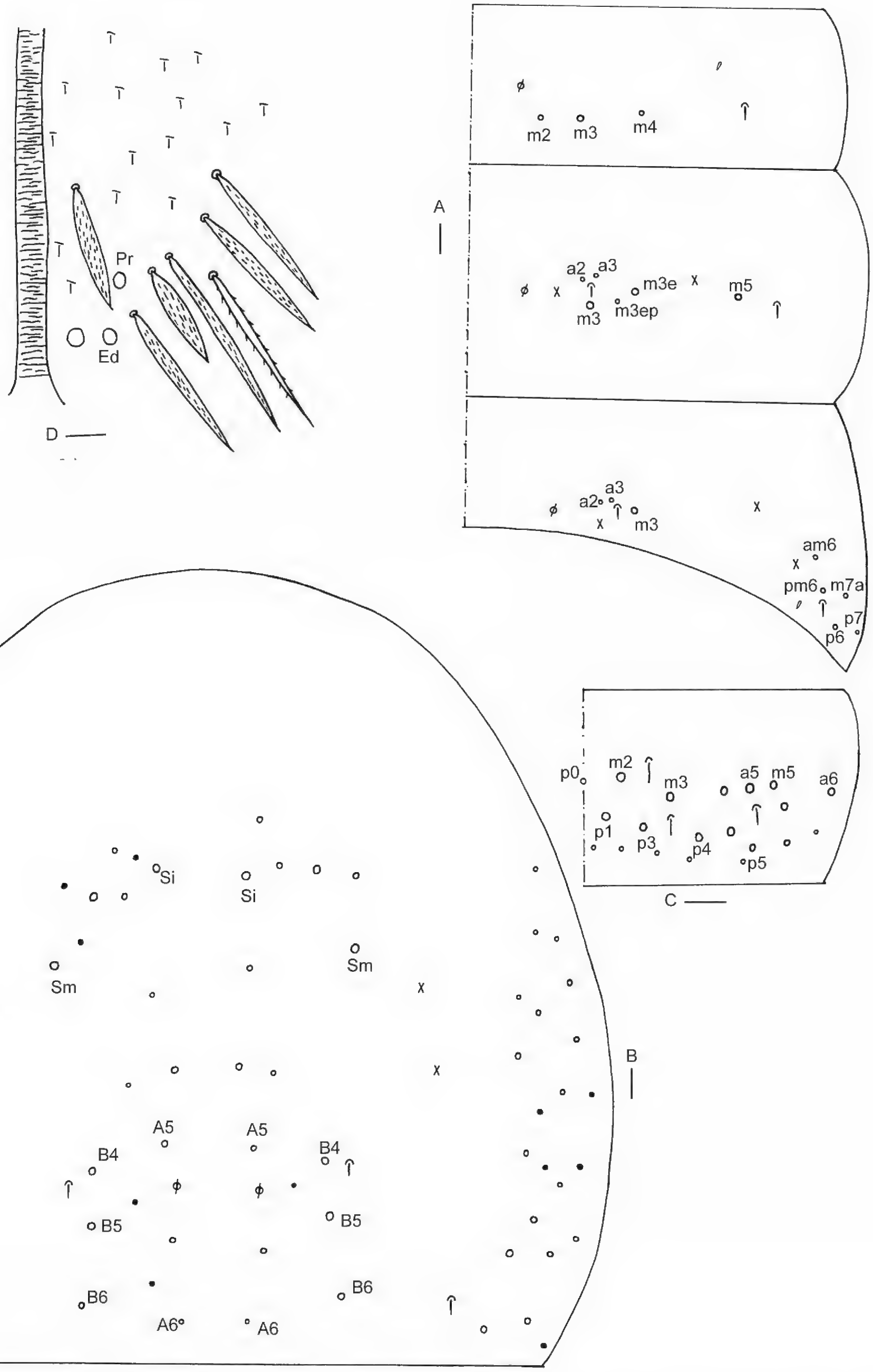

Figure 12. *Lepidosira similis* sp. nov. **A.** Chaetotaxy of Abd. I–III (right side); **B.** Chaetotaxy of Abd. IV (right side and partially left side); **C.** Chaetotaxy of Abd. V (right side); **D.** Anterior face of ventral tube. Scale bars: 20 μm.

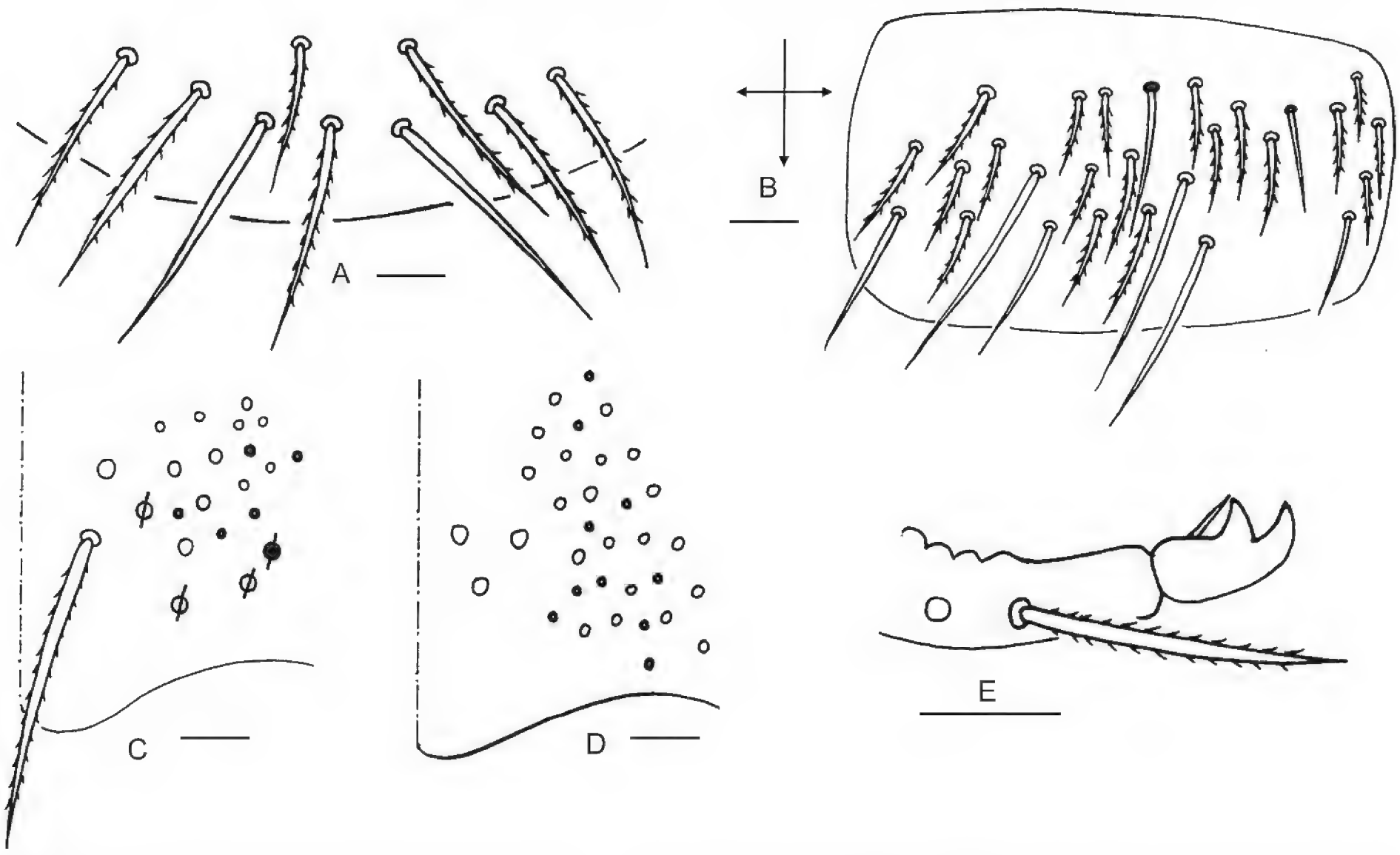

Figure 13. *Lepidosira similis* sp. nov. **A.** Apical chaetae of posterior face of ventral tube; **B.** Lateral flap of ventral tube; **C.** Manubrial plaque (dorsal view); **D.** Ventro–apical part of manubrium; **E.** Distal part of dens and mucro (lateral view). Scale bars: 20 µm.

Abd. III–IV is also similar, but their chaetotaxy of Abd. I and central Abd. II is different. The main differences among the three species in chaetotaxy are listed in Table 3. The new species is also similar to the Indonesian species *L. javana* (Börner, 1913) in color pattern, but the labial base formula is M1M2REL1L2 in the former and mRel1l2 in the latter (Yoshii and Suhardjono 1989). Their dorsal body chaetotaxy is also quite different (Table 3).

Lepidosira wuxiensis sp. nov.

https://zoobank.org/4112D50C-A946-46DD-886F-0CB0D670DD3D

Figs 14–19, Table 3

Type material. ***Holotype.*** CHINA • ♀ on slide; Chongqing Municipality, Wuxi County, the Yintiaoling National Nature Reserve, the Guanshan Protection Station, the Stone Pillar; 2,168.92 m a.s.l.; 31°32'15"N, 109°41'54"E; 28 Jul. 2024; Y.T. Ma leg.; sample number 1321 (CQWX0717).

Paratypes. CHINA • 3 ♀ on slides, same data as holotype.

Diagnosis. Posterior parts of Abd. IV–V violet pigmented; Ant. IV with bilobed apical bulb; head with one mac on Gr. II; Th. II with one medio-medial, two medio-sublateral and 10–12 posterior mac; Th. III to Abd. IV respectively with 8, 4, 3, 2 and 8–9 central mac; Abd. III with four lateral mac.

Description. Body (head + trunk) length up to 2.01 mm, holotype 2.01 mm.

Color pattern: ground color pale yellow; eye patches dark blue; each segment of Ant. I–III distally violet

Figure 14. *Lepidosira wuxiensis* sp. nov. **A**, **B.** Habitus (lateral view). Scale bars: 500 µm.

pigmented, Ant. IV and base of Ant. I with scattered violet pigment; a little violet pigment present on post-ocular region; posterior parts of Abd. IV–V violet pigmented

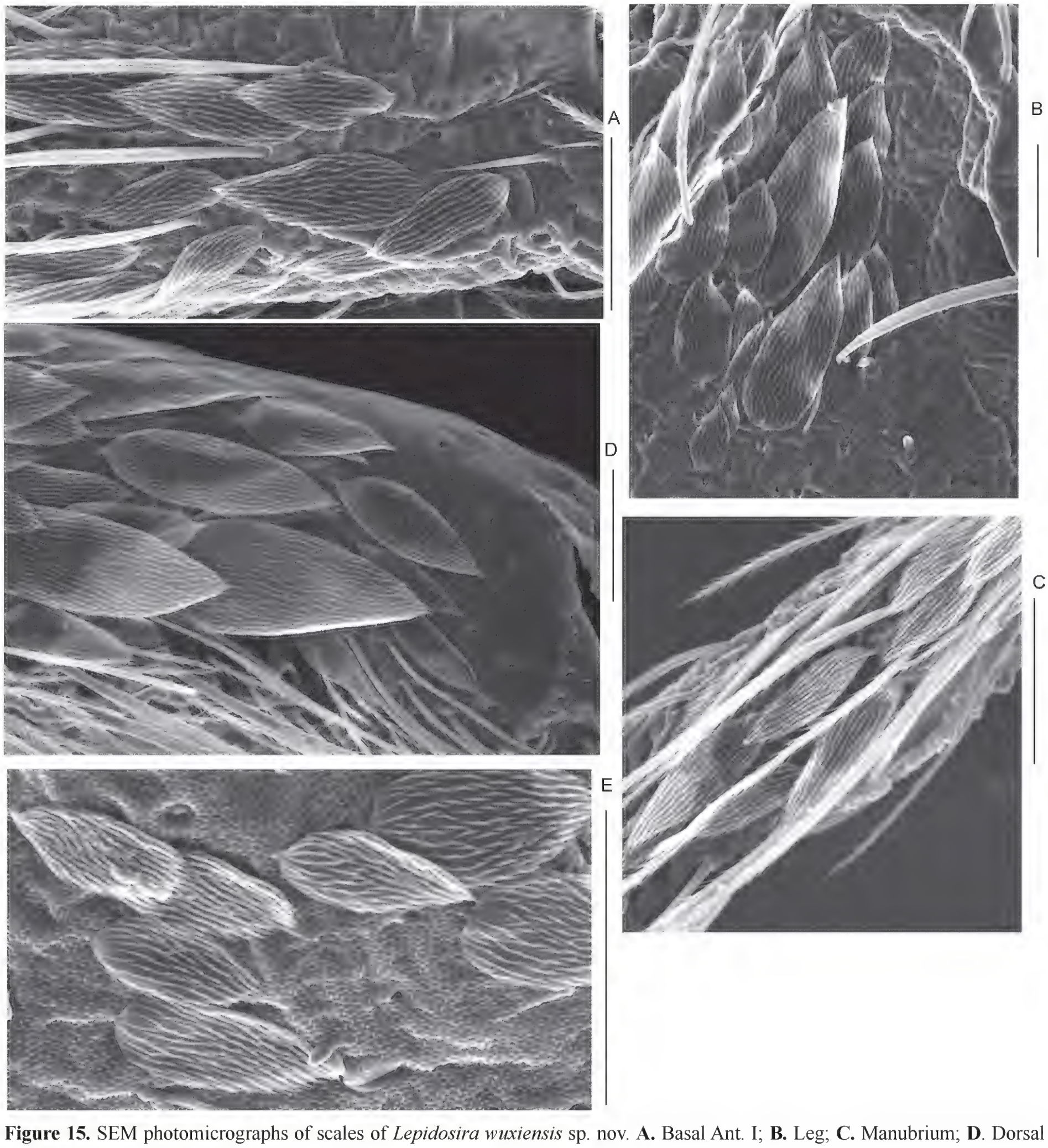

Figure 15. SEM photomicrographs of scales of *Lepidosira wuxiensis* sp. nov. **A.** Basal Ant. I; **B.** Leg; **C.** Manubrium; **D**. Dorsal head; **E.** Trunk. Scale bars: 20 μm.

(Fig. 14A). Scattered violet pigment sometimes present on Th. II–Abd. III and legs (Fig. 14B).

***Scales*:** ciliate type, present on Ant. I–II (Fig. 15A), head (Fig. 15B), legs (Fig. 15C), both faces of ventral tube, ventral side of manubrium and dentes (Fig. 15D), terga (Figs 15E, 16A).

***Head*:** antenna not annulated and 0.56–0.57 (holotype 0.57) times length of body. Ratio of Ant. I–IV as 1.00/1.50–1.73/1.30–1.44/2.22–2.77 (holotype 1.00/1.67/1.40/2.77). Distal part of Ant. IV with many sensory chaetae and normal ciliate chaetae, apical bulb bilobed (Fig. 16B). Ant. III sensory organ with two rods, two spiny guard sensilla, smooth blunt sens, and ciliate chaetae (Fig. 16C). Ant. II with three rods apically (Fig. 16D). Eyes 8+8, G and H smaller than others, interocular chaetae as p, q, r, s, t mes. Dorsal chaetotaxy of head with 7–9 antennal (An), four anterior (A0, A2, A3, A5), four median (M1–4), eight sutural (S0–7) mac, one post-sutural mac (Ps2) mac and mes (Ps5), 12 posterior mac plus one (Pa1) in Gr. II (Fig. 16E). Prelabral and labral chaetae as 4/5, 5, 4, prelabral chaetae ciliate and other smooth, a2 and b2 slightly shorter than middle ones, labral papillae conical (Fig. 16F). Basal chaeta on maxillary outer lobe almost as thick as apical one; sublobal plate with four smooth chaetae-like processes (Fig. 16G).

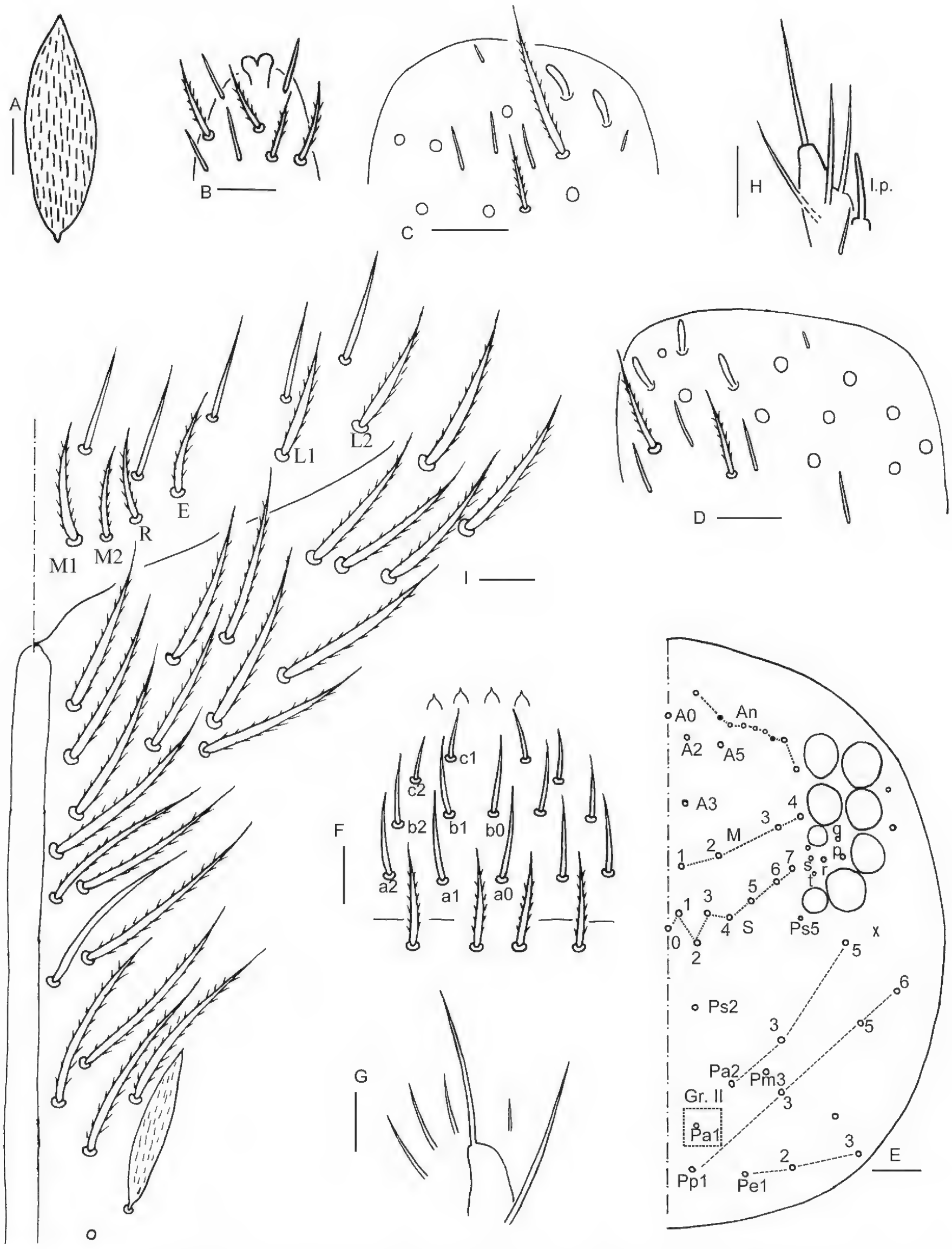

Figure 16. *Lepidosira wuxiensis* sp. nov. **A.** Scale on trunk; **B.** Apex of Ant. IV (dorsal view); **C.** Distal Ant. III (lateral view); **D.** Distal Ant. II (dorsal view); **E.** Dorsal head (dorsal view); **F.** Prelabral and labral chaetotaxy (dorsal view); **G.** Maxillary palp and outer lobe (right side); **H.** Labial palp (right side); **I.** Labial and post-labial chaetotaxy (right side). Scale bars: 20 μm.

Lateral process (l. p.) of labial palp E finger-like with tip almost or not reaching apex of papilla E (Fig. 16H). Labial base with $M_1M_2REL_1L_2$, all ciliate (Fig. 16I).

***Thorax*:** tergal ms formula on Th. II–Abd. V as 1, 0/1, 0, 1, 0, 0, sens as 2, 2/1, 2, 2, 2, 3 (Figs 17A, 18A–C). Th. II with about nine anterior, one medio-medial (m1), two medio-sublateral (m4, m4i), 10–12 posterior mac. Th. III with eight central and six lateral mac (Fig. 17A). Coxal chaetal formula as 4–6/8–9 (anterior), 4–10 (posterior)/9–10 (Fig. 17B–D). Trochanteral organ with 25–58 smooth chaetae (Fig. 17E). Tenent hair smooth and clavate, 1.12–1.25 length of inner edge of unguis; unguis with a

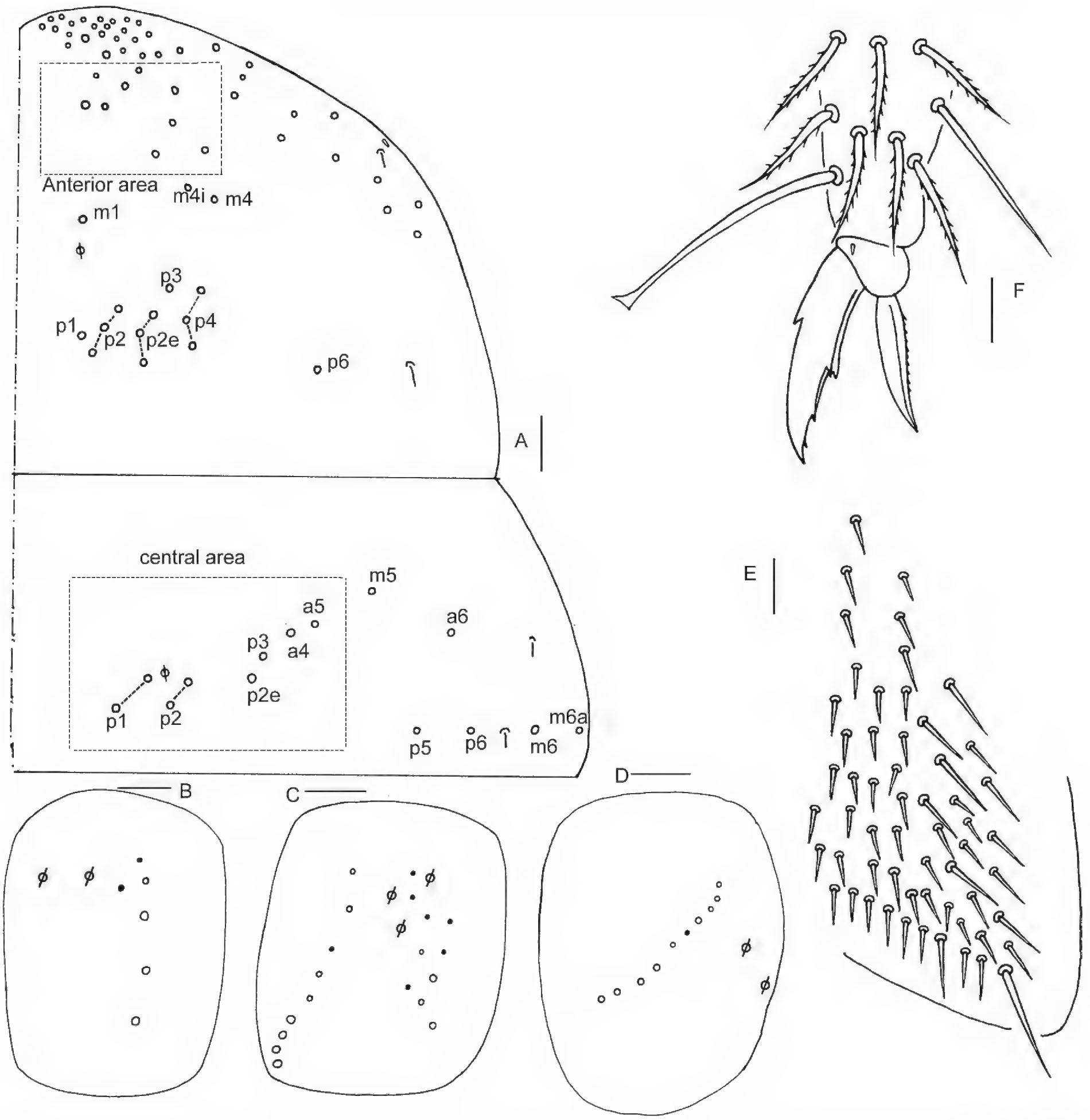

Figure 17. *Lepidosira wuxiensis* sp. nov. **A.** Chaetotaxy of Th. II–III (dorsal view); **B–D.** Coxal chaetotaxy of fore, middle, and hind legs (outer view); **E.** Trochanteral organ (posterior side); **F.** Hind foot complex (lateral view). Scale bars: 20 μm.

pair of laterobasal outer teeth and four inner teeth, basal paired inner teeth located at 0.46–0.49 distance from base of inner edge of unguis, distal unpaired inner teeth at 0.71–0.74 and 0.85–0.88 distance from base, respectively; unguiculus lanceolate, outer edge slightly serrate (Fig. 17F).

***Abdomen*:** range of Abd. IV length as 3.29–5.67 (holotype 4.81) times as dorsal axial length of Abd. III. Abd. I with four (m2–4, m4i) mac. Abd. II with three (a2, m3, m3e) central, one (m5) lateral mac. Abd. III with two (a2, m3) central, four (am6, pm6, m7a, p6) lateral mac (Fig. 18A). Abd. IV with two normal sens, 8–9 central, 13–16 lateral mac (Fig. 18B). Abd. V with three sens (Fig. 18C). Anterior face of ventral tube with 3+3 large and 4–6 small ciliate chaetae, line connecting proximal (Pr) and external-distal (Ed) mac oblique to median furrow (Fig. 18D); posterior face with two apical smooth chaetae besides about 35 ciliate chaetae of different sizes (Fig. 19A); each lateral flap with five smooth and nine ciliate chaetae (Fig. 19B). Manubrial plate dorsally with 16–20 ciliate mac and three pseudopores (Fig. 19C); ventrally with 27–31 ciliate chaetae (Fig. 19D). Mucro bidentate; tip of basal spine reaching apex of subapical tooth; distal smooth section of dens slightly longer than mucro in length (Fig. 19E).

Etymology. The name is composed of the locality name Wuxi plus the Latin suffix "-*ensis*," meaning pertaining or originating, referring to its type locality, Wuxi County.

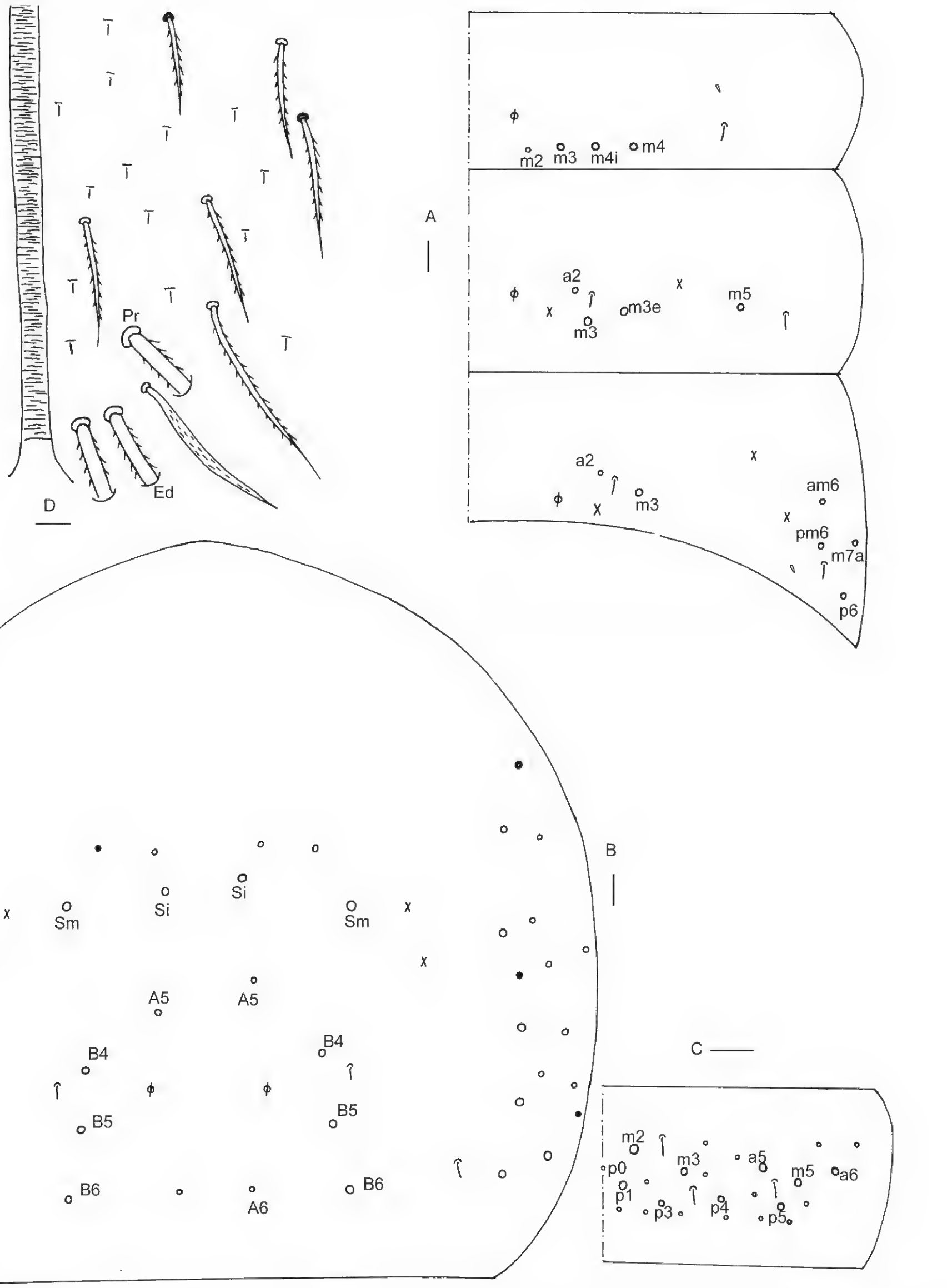

Figure 18. *Lepidosira wuxiensis* sp. nov. **A.** Chaetotaxy of Abd. I–III (right side); **B.** Chaetotaxy of Abd. IV (right side and partially left side); **C.** Chaetotaxy of Abd. V (right side); **D.** Anterior face of ventral tube. Scale bars: 20 μm.

Habitat. Found in litter of subtropical forests, mainly composed of leaves of *Buxus sinica*, *Ilex yunnanensis*, *Pinus armandii*, and *Rosa corymbulosa*.

Remarks. The new species can be easily distinguished from other species by its color pattern, although it is somewhat similar to the New Zealand species *L. dorsalis* (Salmon, 1941). However, only the posterior part of Abd. IV is brown pigmented in the former, and almost the whole part of Abd. IV is pigmented in the latter. The main differences between the new species and the other Chinese species of the genus in chaetotaxy are listed in Table 3.

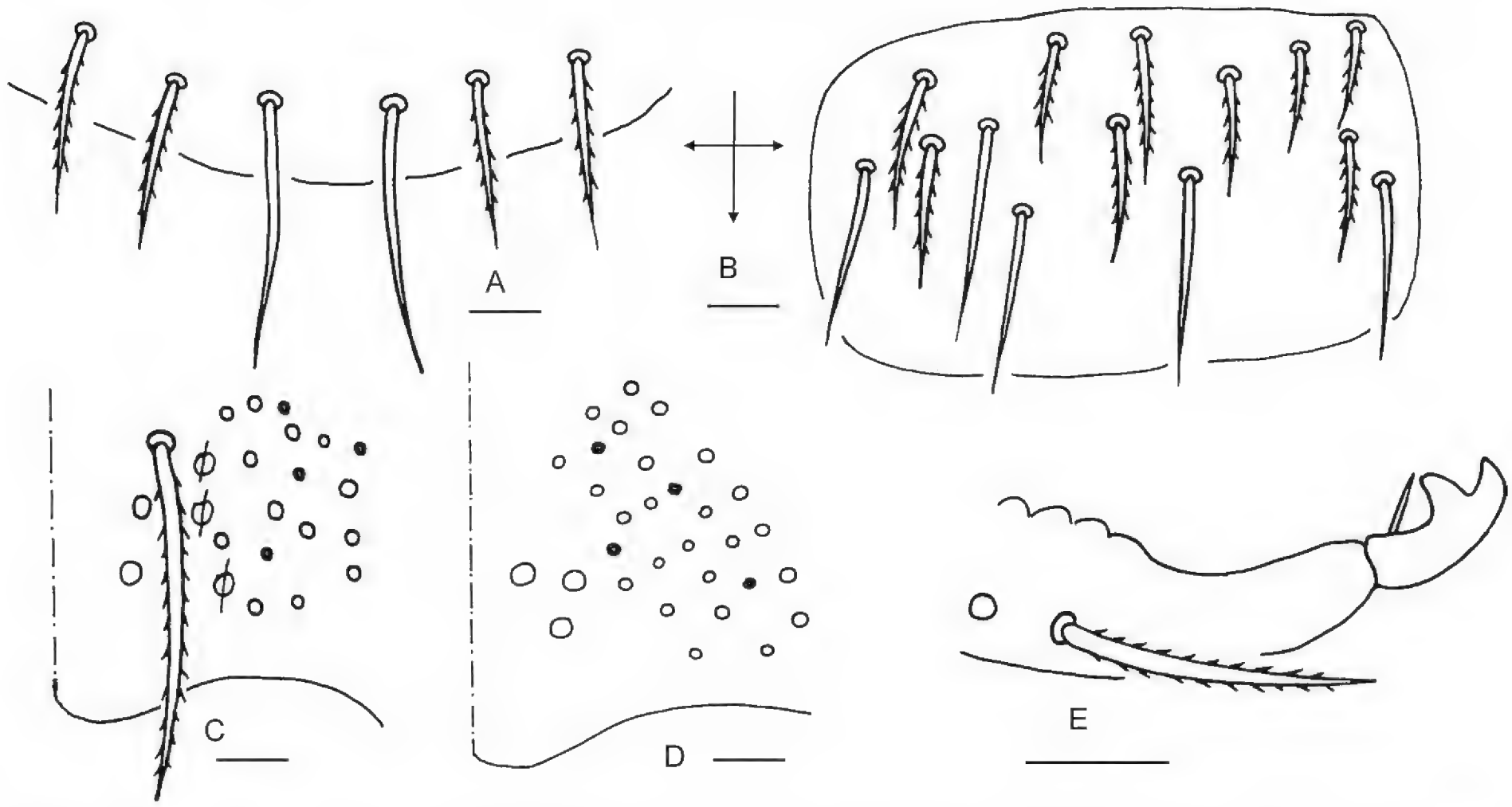

Figure 19. *Lepidosira wuxiensis* sp. nov. **A.** Apical chaetae of posterior face of ventral tube; **B.** Lateral flap of ventral tube; **C.** Manubrial plaque (dorsal view); **D.** Ventro–apical part of manubrium; **E.** Distal part of dens and mucro (lateral view). Scale bars: 20 μm.

Lepidosira chongqingensis sp. nov.

https://zoobank.org/EC5D94EC-7F94-4499-9A0E-9B88F74154E5

Figs 20–25, Table 3

Type material. ***Holotype.*** CHINA • ♀ on slide; Chongqing Municipality, Wuxi County, the Yintiaoling National Nature Reserve, the Hongqi Protection Station, the Tianchi Dam; 1,762.16 m a.s.l.; 31°31'39"N, 109°47'18"E; 23 Jul. 2024; Y.T. Ma leg.; sample number 1311 (CQWX0706).

Paratypes. CHINA • 3 ♀ on slides, same data as holotype.

Diagnosis. Ant. IV, distal Ant. III, and basal Ant. I. with scattered violet pigment; Ant. IV with bilobed apical bulb; head with three mac on Gr. II; Th. II with 3 (2) medio-medial, three medio-sublateral and 17–19 posterior mac; Th. III to Abd. IV respectively with 12, 4, 6, 3 (2), and 18–25 central mac; Abd. III with five lateral mac.

Description. Body (head + trunk) length up to 1.84 mm, holotype 1.84 mm.

***Color pattern*:** ground color pale yellow; eye patches dark blue; Ant. IV, distal Ant. III, and basal Ant. I. with scattered violet pigment; a little violet pigment present in post-ocular region and sometimes on coxae (Fig. 20A, B).

***Scales*:** ciliate type, present on Ant. I–II, basal Ant. III, legs (Fig. 21A), both faces of ventral tube, ventral side of manubrium and dentes (Fig. 21B, C), head, and terga (Figs 21D, 22A).

***Head*:** antenna not annulated and 0.65–0.75 (holotype 0.65) times length of body. Ratio of Ant. I–IV as 1.00/1.33–2.00/1.24–1.57/2.00–3.10 (holotype 1.00/1.78/1.33/2.67). Distal part of Ant. IV with many sensory chaetae and normal ciliate chaetae, apical bulb

Figure 20. *Lepidosira chongqingensis* sp. nov. **A**, **B.** Habitus (**A**, lateral view; **B,** dorsal view). Scale bars: 500 μm.

bilobed (Fig. 22B). Ant. III sense organ with two rods, two spiny guard sensilla, smooth blunt sens, and ciliated chaetae (Fig. 22C). Ant. II with two rods apically (Fig. 22D). Eyes 8+8, G and H smaller than others, interocular chaetae as p, r, t mes. Dorsal chaetotaxy of head with 8–11 antennal (An), four anterior (A0, A2, A3, A5), four median (M1–4), eight sutural (S0–7) mac, one post-sutural mac (Ps2) and mes (Ps5),

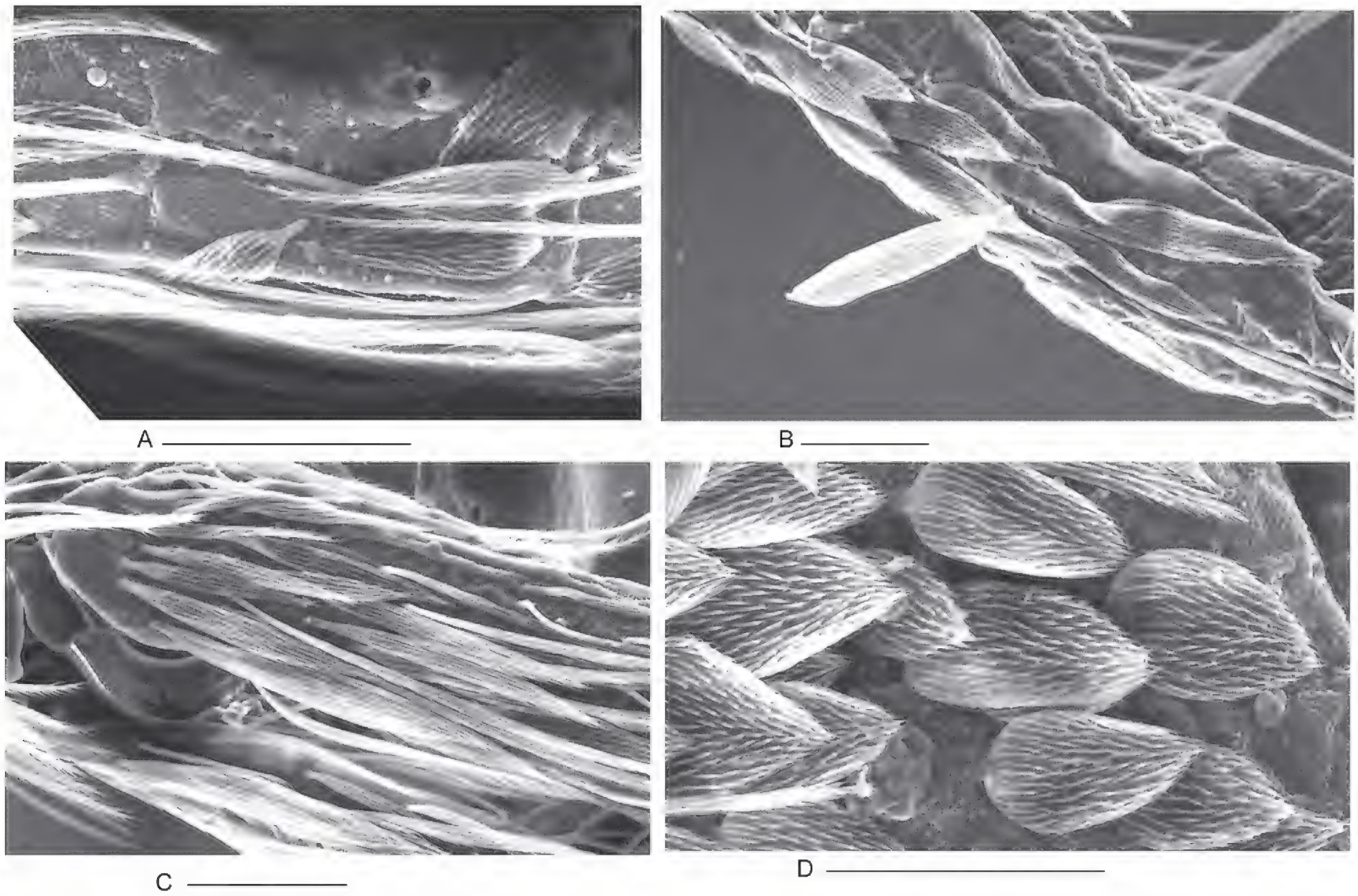

Figure 21. SEM photomicrographs of scales of *Lepidosira chongqingensis* sp. nov. **A.** Leg; **B.** Manubrium; **C.** Dens; **D.** Trunk. Scale bars: 20 μm.

13 posterior mac plus three mac (Pi1, Pa1, Pm1) in Gr. II (Fig. 22E). Prelabral and labral chaetae as 4/5, 5, 4, prelabral chaetae ciliate and other smooth, a2 and b2 slightly shorter than middle ones, labral papillae conical (Fig. 22F). Basal chaeta on maxillary outer lobe almost as thick as apical one; sublobal plate with four smooth chaetae-like processes (Fig. 22G). Lateral process (l. p.) of labial palp E finger-shaped with tip not reaching apex of papilla E (Fig. 22H). Labial base with $M_1M_2REL_1L_2$, all ciliate (Fig. 22I).

***Thorax*:** tergal ms formula on Th. II–Abd. V as 1, 0/1, 0, 1, 0, 0, sens as 2, 2/1, 2, 2, 2, 3 (Figs 23A, 24A–C). Th. II with 11–12 anterior, 3 (2) medio-medial (m1, m2, m2i may be absent), three medio-sublateral (m4, m4i, m4p), 17–19 posterior mac. Th. III with 12 central and seven lateral mac (Fig. 23A). Coxal chaetal formula as 5–9/13–16 (anterior), 8–14 (posterior)/15–23 (Fig. 23B–D). Trochanteral organ with 70–97 smooth chaetae (Fig. 23E). Tenent hair smooth and clavate, 1.21–1.28 length of inner edge of unguis; unguis with a pair of laterobasal outer teeth and four inner teeth, basal paired inner teeth located at 0.42–0.43 distance from base of inner edge of unguis, distal unpaired inner teeth at 0.65–0.69 and 0.86–0.89 distance from base, respectively; unguiculus lanceolate, outer edge slightly serrate (Fig. 23F).

***Abdomen*:** range of Abd. IV length as 4.08–7.00 (holotype 6.67) times as dorsal axial length of Abd. III. Abd. I with four (m2–4, m4i) mac. Abd. II with six (a2, a3, m3, m3e, m3ea, m3ep) central, one (m5) lateral mac. Abd. III with 3 (2) (a2, m3, a3 absent on one side of one specimen) central, five (am6, pm6, m7a, p6, p7) lateral mac (Fig. 24A). Abd. IV with two normal sens, 18–25 central, 18–20 lateral mac (Fig. 24B). Abd. V with three sens (Fig. 24C). Anterior face of ventral tube with 3+3 large and seven small ciliate chaetae, line connecting proximal (Pr) and external-distal (Ed) mac oblique to median furrow (Fig. 24D); posterior face with 2–3 apical smooth chaetae besides about 35 ciliate chaetae of different sizes (Fig. 25A); each lateral flap with five smooth and 20–22 ciliate chaetae (Fig. 25B). Manubrial plate dorsally with 14–21 ciliate mac and four pseudopores (Fig. 25C); ventrally with 33–41 ciliate chaetae (Fig. 25D). Mucro bidentate; tip of basal spine reaching apex of subapical tooth; distal smooth section of dens slightly longer than mucro in length (Fig. 25E).

Etymology. The name is composed of the locality name Chongqing plus the Latin suffix "-*ensis*," meaning pertaining or originating, referring to its type locality, Chongqing Municipality.

Habitat. Found in litter of subtropical forests, mainly composed of leaves of *Buxus sinica*, *Dendrobenthamia japonica* var. *chinensis*, *Ilex yunnanensis*, *Rosa corymbulosa*, and *Viburnum betulifolium*.

Remarks. The new species is similar to the Indian species *L. pallida* (Ritter, 1911) and *L. unguserrata* Salmon, 1970, and the Vietnamese species *L. alba* (Nguyên, 2005), because all these species lack violet or blue pigment on the trunk. However, *L. palli-*

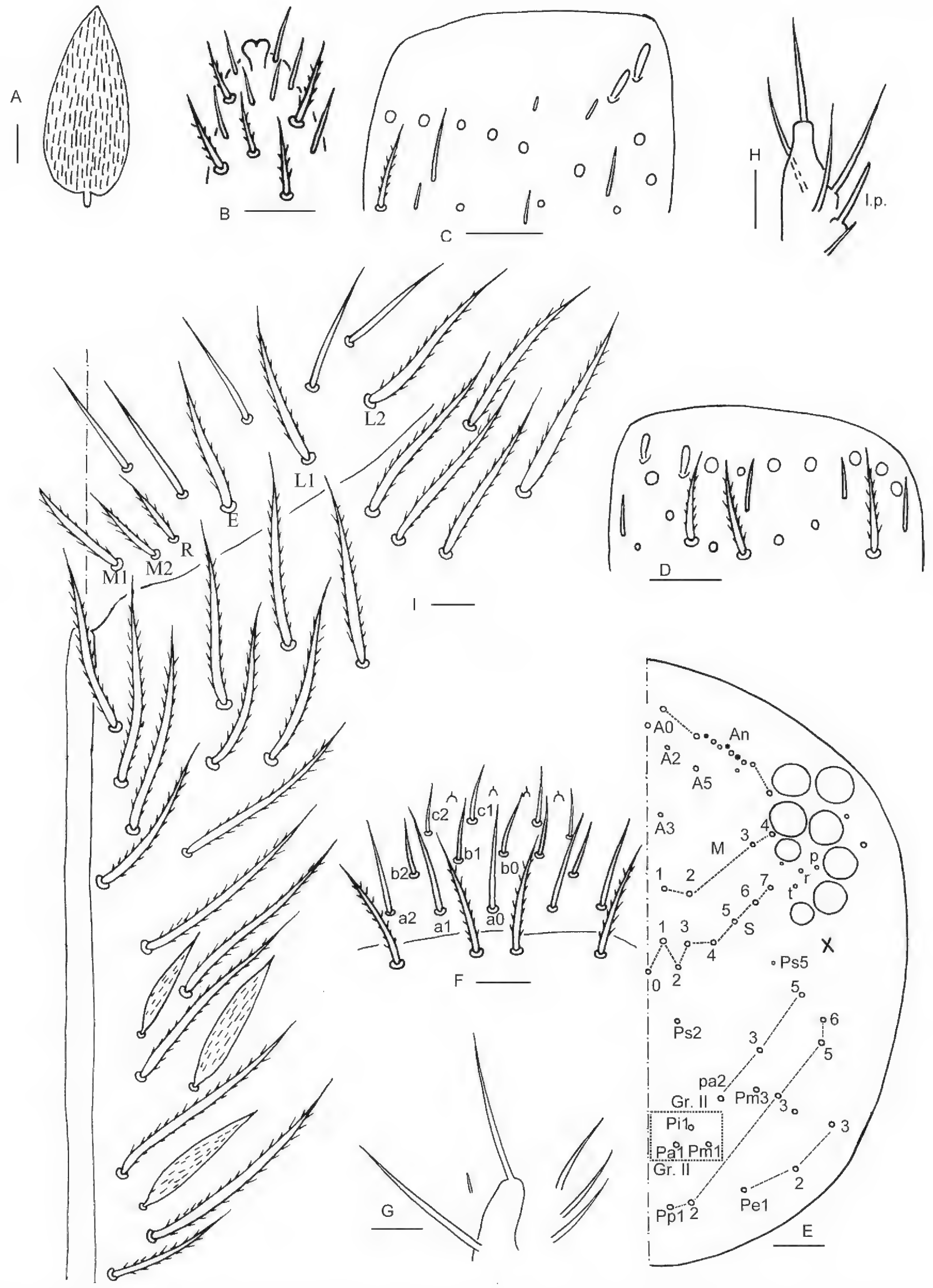

Figure 22. *Lepidosira chongqingensis* sp. nov. **A.** Scale on trunk; **B.** Apex of Ant. IV (dorsal view); **C.** Distal Ant. III (lateral view); **D.** Distal Ant. II (dorsal view); **E.** Dorsal head (dorsal view); **F.** Prelabral and labral chaetotaxy (dorsal view); **G.** Maxillary palp and outer lobe (right side); **H.** Labial palp (right side); **I.** Labial and post-labial chaetotaxy (right side). Scale bars: 20 μm.

da (Ritter, 1911) is characterized by one inner tooth on the unguis, *L. unguserrata* Salmon, 1970, by the unilobed apical bulb on Ant. IV, and *L. alba* (Nguyên, 2005) by two mac on Abd. I. The new species is also similar to the Chinese species *L. baojiensis* nom. nov. and *L. trifascia* (Zhou & Ma, 2022), comb. nov. in the chaetotaxy of the dorsal head, Th. II–III, and Abd. II–IV, but Abd. I has four mac in the former and seven in the latter two species. Detailed comparisons among them are listed in Table 3.

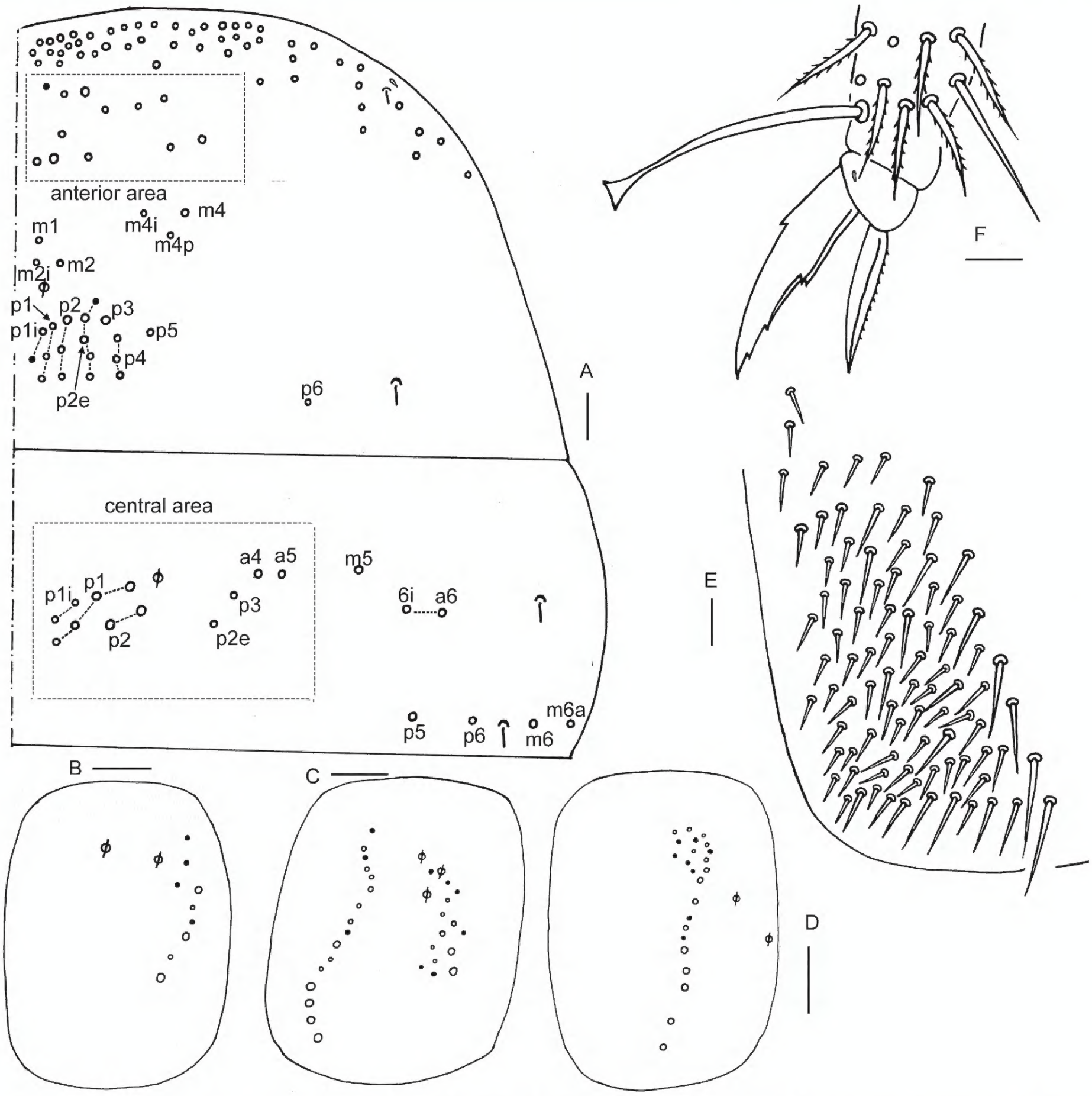

Figure 23. *Lepidosira chongqingensis* sp. nov. **A.** Chaetotaxy of Th. II–III (right side); **B–D.** Coxal chaetotaxy of fore, middle, and hind legs (outer view); **E.** Trochanteral organ (posterior side); **F.** Hind foot complex (lateral view). Scale bars: 20 μm.

***Lepidosira baojiensis* comb. et nom. nov.**

Willowsia flava Zhou, Pan & Ma, 2021: 74, junior homonym of *Lepidosira flava* (Salmon, 1938).

Etymology. The name is composed of the locality name Baoji plus the Latin suffix –"-*ensis*," meaning pertaining or originating, referring to its locality, Baoji City.

Diagnosis. Blue pigment absent on dorsal body; Ant. IV with bilobed apical bulb; head with three mac on Gr. II; Th II with three (m1, m2, m2i) medio-medial, three medio-sublateral (m4, m4i, m4p), and 22–23 posterior mac; Th. III to Abd. IV respectively with 12–13, 7, 6, 3, and 16–20 central mac; Abd. III with five lateral mac.

Remarks. After checking the type material of this species, we confirm that there are scales on the dentes and no blunt chaetae on the manubrial plates. Hence, we propose its transfer to *Lepidosira* herein. As a consequence, *Willowsia flava* Zhou, Pan & Ma, 2021, becomes a junior secondary homonym of *Lepidosira flava* (Salmon, 1938). Thus, the new replacement name, *Lepidosira baojiensis* comb. et nom. nov., is being proposed herein.

***Lepidosira trifascia* (Zhou & Ma, 2022) comb. nov.**

Willowsia trifascia Zhou & Ma, 2022: 372.

Diagnosis. Three longitudinal blue stripes present on dorsal body; Ant. IV with bilobed apical bulb; head with three mac on Gr. II; Th. II with three (m1, m2, m2i) medio-medial, three medio-sublateral (m4, m4i, m4p), and 25–27

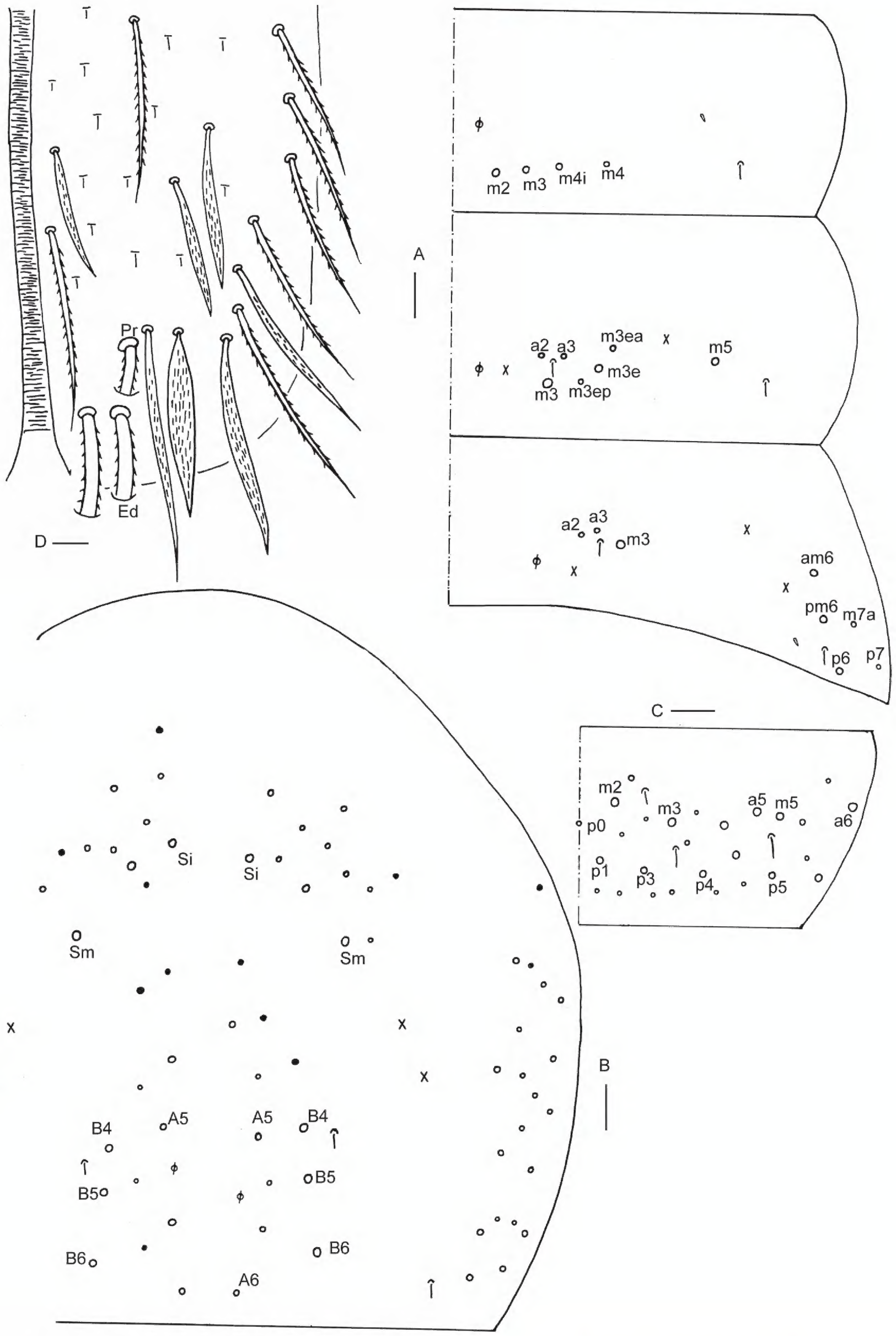

Figure 24. *Lepidosira chongqingensis* sp. nov. **A.** Chaetotaxy of Abd. I–III (right side); **B.** Chaetotaxy of Abd. IV (right side and partially left side); **C.** Chaetotaxy of Abd. V (right side); **D.** Anterior face of ventral tube. Scale bars: 20 μm.

posterior mac; Th. III to Abd. IV respectively with 16, 7, 6, 3, and 16–20 central mac; Abd. III with five lateral mac.

Remarks. After examining the type material of this species, we confirm that scales are present on the dentes and no blunt chaetae are found on the manubrial plate. Hence, we propose its transfer to *Lepidosira* herein. It can be distinguished from the other known *Lepidosira* species by its three longitudinal blue stripes on the dorsal body.

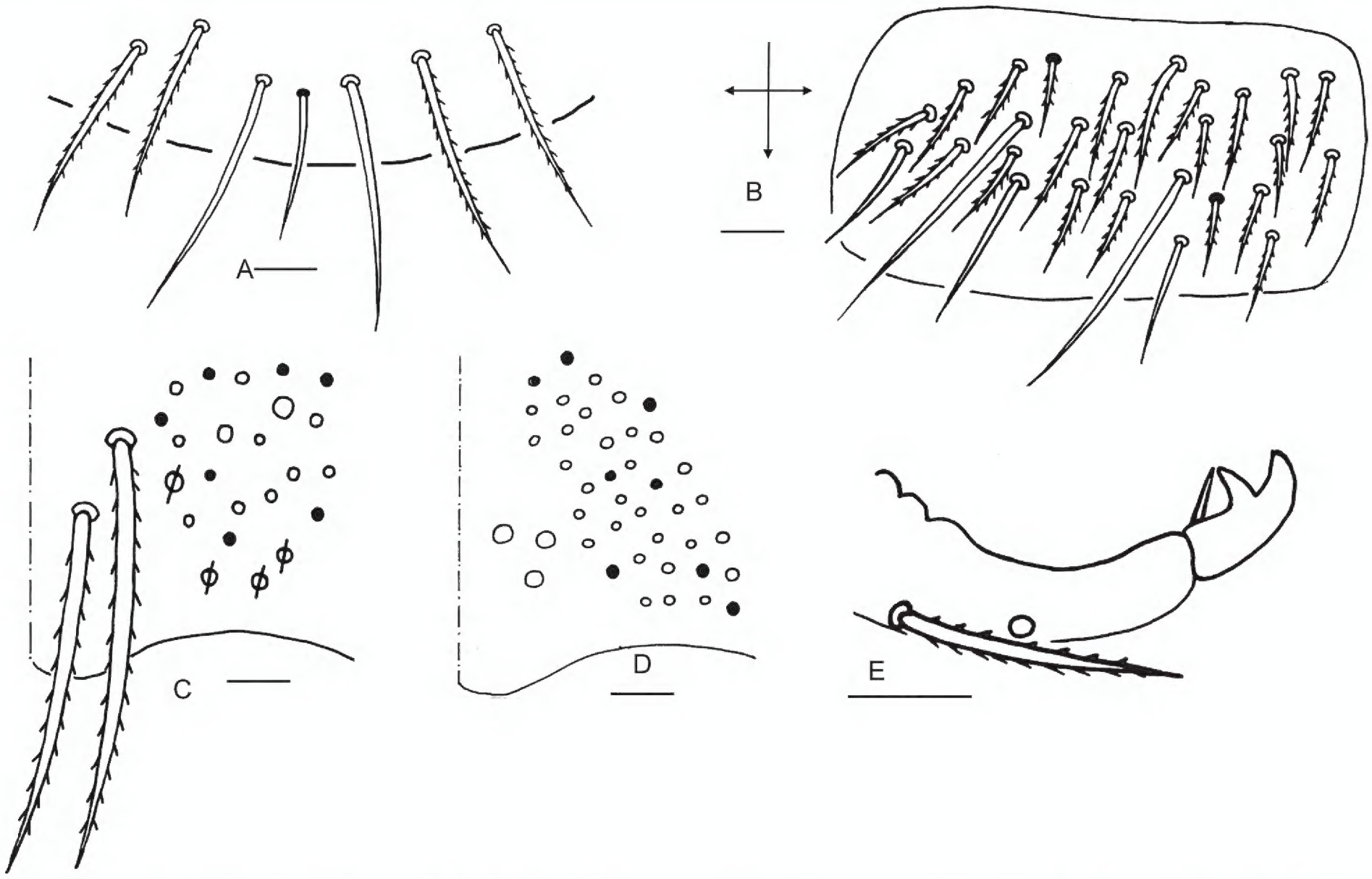

Figure 25. *Lepidosira chongqingensis* sp. nov. **A.** Apical chaetae of posterior face of ventral tube; **B.** Lateral flap of ventral tube; **C.** Manubrial plaque (dorsal view); **D.** Ventro–apical part of manubrium; **E.** Distal part of dens and mucro (lateral view). Scale bars: 20 μm.

Discussion

There are about 9,600 species of Collembola worldwide (Bellinger et al. 1996–2024), but many of these species were diagnosed primarily based on color pattern. Some cryptic species occur in several Collembola genera, such as *Tomocerus* (Zhang et al. 2014), *Coecobrya* (Zhang et al. 2018), and *Entomobrya* (Katz et al. 2015). Molecular methods are very useful for separating species with similar color patterns (Schneider et al. 2011; Porco et al. 2012).

Among the fifteen species of *Lepidosira* from Asia and South America, six (*L. calolepis* (Börner, 1913), *L. gigantea* (Börner, 1909), *L. javana* (Börner, 1913), *L. nigropunctata* (Nguyên, 2005), *L. sundana* Yoshii & Suhardjono, 1989, and *L. trifascia* (Zhou & Ma, 2022), comb. nov.) have a distinct irregular longitudinal stripe along the lateral side of the trunk from Th. II to Abd. IV. The species *L. wuxiensis* sp. nov. is characterized by violet pigment on the posterior part of Abd. IV, and *L. neotropicalis* Nunes & Bellini, 2019, by blue pigment on the dorsal and ventral head anteriorly. There is no great difference in color pattern among the other seven species. However, *L. pallida* (Ritter, 1911) is characterized by one inner tooth on the unguis, and *L. unguserrata* Salmon, 1970, by the unilobed apical bulb on Ant. IV. *Lepidosira baojiensis* comb. et nom. nov. has seven mac on Abd. I; *L. alba* (Nguyên, 2005) has two mac; *L. similis* sp. nov. has three mac; and both *L. apigmenta* sp. nov. and *L. chongqingensis* sp. nov. have four mac on Abd. I. *L. apigmenta* sp. nov. has four central mac on Abd. II, and *L. chongqingensis* sp. nov. has six mac (Table 3).

The genetic distances in the sequences of the COI gene among the seven species were significantly large (Table 2). They corroborated the observed morphological differences, thus providing strong evidence supporting the new species described in the present study.

Acknowledgments

This study was supported by the National Natural Science Foundation of China (32370447) and the Large Instruments Open Foundation of Nantong University (KFJN2475). We also thank Dr. Zhang Zhisheng of Southwest University, China, for assistance with specimen collection.

References

Bellinger PF, Christiansen KA, Janssens F (1996–2024) Checklist of the Collembola of the World. http://www.collembola.org [accessed 8 March 2025]

Börner C (1909) Japan's Collembolenfauna. (Vorläufige Mitteilung). Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin 2: 99–135.

Börner C (1913) Die Familien der Collembolen. Zoologischer Anzeiger 41: 315–322.

Christiansen KA (1990) Insecta: Collembola. In: Dindal DL (Ed.) Soil biology guide. John Wiley & Sons, New York, Chichester, etc., 965–995.

Ellis WN, Bellinger (1973) An annotated list of the generic names of Collembola (Insecta) and their type species. Entomologische Vereniging 7: 1–74.

Gisin H (1964) European Collembola. VII. Revue Suisse de Zoologie 71(4): 649–678. https://doi.org/10.5962/bhl.part.75615

Godeiro NN, Ding YH, Cipola NG, Jantarit S, Bellini BC, Zhang F (2023) Phylogenomics and systematics of Entomobryoidea (Collembola): Marker design, phylogeny and classification. Cladistics : The International Journal of the Willi Hennig Society 39(2): 101–115. https://doi.org/10.1111/cla.12521

Greenslade P, Stevens MI, Torricelli G, D'Haese CA (2011) An ancient Antarctic endemic genus restored: morphological and molecular support for *Gomphiocephalu hodgsoni* (Collembola: Hypogastruridae). Systematic Entomology 36: 223–240. https://doi.org/10.1111/j.1365-3113.2010.00553.x

Jordana R, Baquero E (2005) A proposal of characters for taxonomic identification of *Entomobrya* species (Collembola, Entomobryomorpha), with description of a new species. Abhandlungen und Berichte des Naturkundemuseums Goerlitz 76(2): 117–134.

Katz AD, Giordano R, Soto-Adames F (2015) Taxonomic review and phylogenetic analysis of fifteen North American *Entomobrya* (Collembola, Entomobryidae), including four new species. ZooKeys 525: 1–75. https://doi.org/10.3897/zookeys.525.6020

Kimura M (1980) A sample method for estimating evolutionary rates of base substitution through comparative studies of nucleotide-sequences. Journal of Molecular Evolution 16: 111–120. https://doi.org/10.1007/BF01731581

Lubbock J (1873) Monograph of the Collembola and Thysanura. Ray Society, London, 276 pp. https://doi.org/10.5962/bhl.title.11583

Mari-Mutt JA (1979) A revision of the genus *Dicranocentrus* Schött (Insecta: Collembola: Entomobryidae). Agricultural Experiment Station Bulletin 259: 1–79.

Mari-Mutt JA (1986) Puerto Rican species of *Lepidocyrtus* and *Pseudosinella* (Collembola: Entomobryidae). Caribbean Journal of Science 22(1–2): 1–48.

Nguyên TT (2005) Seven new springtail species (Collembola, Entomobryidae) from Vietnam. Journal of Biology 27(1): 8–17.

Nunes RC, Godeiro NN, Pacheco G, Liu SL, Gilbert MTP, Alvarez-Valin F, Zhang F, Bellini BC (2019) The discovery of Neotropical *Lepidosira* (Collembola, Entomobryidae) and its systematic position. Zoologica Scripta 48(6): 783–800. https://doi.org/10.1111/zsc.12377

Porco D, Potapov M, Bedos A, Busmachiu G, Weiner WM, Hamra-Kroua S, Deharveng L (2012) Cryptic diversity in the ubiquist species *Parisotoma notabilis* (Collembola, Isotomidae): A long-used chimeric species? PLoS ONE 7: e46056. https://doi.org/10.1371/journal.pone.0046056

Ritter W (1911) Neue Thysanuren und Collembolen aus Ceylon und Bombay, gesammelt von Dr. Uzel. Annalen des K. K. Naturhistorischen Hofmuseums Wien 24: 379–398.

Salmon JT (1938) A new genus of Collembola in New Zealand and the genus *Lepidosira*. Transactions of the Royal Society of New Zealand 68: 349–361.

Salmon JT (1941) The Collembolan fauna of New Zealand, including a discussion of its distribution and affinities. Transactions of the Royal Society of New Zealand 70: 282–431.

Salmon JT (1956) LXXIX. Contributions à l'étude de la fauna entomologique du Ruanda-Urundi (Mission P. Basilewsky 1953). LXXIX. Collembola. Annales du Musée Royal du Congo Belge 8: 9–40.

Salmon JT (1970) Some new records and new species of Collembola from India. Transactions of the Royal Society of New Zealand 12(13): 145–152.

Schäffer C (1896) Die Collembolen der Umgebung von Hamburg und benachtbaren Gebeite. Mittheilungen aus dem Naturhistorischen Musenm 13: 147–216.

Schneider C, Cruaud C, D'Haese CA (2011) Unexpected diversity in Neelipleona revealed by molecular phylogeny approach (Hexapoda, Collembola). Soil Organisms 83: 383–398.

Schött H (1917) Results of Mr. E. Mjobergs Swedish Scientific Expeditions to Australia 1910–1913. 15. Collembola. Arkiv för Zoologi 11: 1–60. https://doi.org/10.5962/bhl.part.1497

Schött H (1925) IX. Collembola from Mt. Murid and Mt. Dulit in Northern Sarawak. Sarawak Museum Journal 3: 107–127.

Shoebotham JW (1917) Notes on the Collembola, part 4. The classification of the Collembola; with a list of genera known to occur in the British Isles. Annals & Magazine of Natural History 8: 425–436. https://doi.org/10.1080/00222931709486959

Szeptycki A (1973) North Korean Collembola. I. The genus *Homidia* Börner 1906 (Entomobryidae). Acta Zoologica Cracoviensia 31: 23–40.

Szeptycki A (1979) Morpho-systematic studies on Collembola. IV. Chaetotaxy of the Entomobryidae and its phylogenetical significance. Polska Akademia Nauk, Kraków, 219 pp.

Tamura K, Peterson D, Peterson N, Stecher G, Nei M, Kumar S (2011) MEGA5: Molecular evolutionary genetics analysis using maximum likelihood, evolutionary distance, and maximum parsimony methods. Molecular Biology and Evolution 28: 2731–2739. https://doi.org/10.1093/molbev/msr121

Tömösvary O (1882) Adatok Hazánk Thysanure-Faunájához. A Mathematikai és Természettudományi Osztályok Közlönye 18: 119–130.

Yoshii R (1992) Identity of some Japanese Collembola. Acta Zoologica Asiae Orientalis 1: 97–110.

Yoshii R, Suhardjono YR (1989) Notes on the Collembolan Fauna of Indonesia and its vicinities. I. Miscellaneous notes, with special references to Seirini and Lepidocyrtini. Acta Zoologica Asiae Orientalis 1: 23–90.

Zhang ZS (2025) Preface: Diversity of Yintiaoling Nature Reserve, II. Zootaxa 5652(1): 005–006. http://doi.org/10.11646/zootaxa.5652.1.3

Zhang F, Deharveng L (2015) Systematic revision of Entomobryidae (Collembola) by integrating molecular and new morphological evidence. Zoologica Scripta 44: 298–311. https://doi.org/10.1111/zsc.12100

Zhang F, Yu DY, Luo YZ, Ho SYW, Wang BX, Zhu CD (2014) Cryptic diversity, diversification and vicariance in two species complexes of *Tomocerus* (Collembola, Tomoceridae) from China. Zoologica Scripta 43: 393–404. https://doi.org/10.1111/zsc.12056

Zhang F, Jantarit S, Nilsai A, Stevens MI, Ding YH, Satasook C (2018) Species delimitation in the morphologically conserved *Coecobrya* (Collembola: Entomobryidae): A case integrating morphology and molecular traits to advance current taxonomy. Zoologica Scripta 47(3): 342–356. https://doi.org/10.1111/zsc.12279

Zhang F, Bellini BC, Soto-Adames FN (2019) New insight into the systematics of Entomobryoidea (Collembola: Entomobryomorpha): first instar chaetotaxy, homology and classification. Zoological Systematics 44(4): 249–278. https://doi.org/10.11865/zs.201926

Zhou R, Ma YT (2022) Three new species of Entomobryinae (Collembola, Entomobryidae) from Gansu, China. Zootaxa 5155(3): 371–392. https://doi.org/10.11646/zootaxa.5155.3.4

Zhou R, Pan ZX, Ma YT (2021) Three new species *Willowsia* (Collembola: Entomobryidae) from China and notes on *W. japonica*. Zootaxa 4991(1): 073–092. http://doi.org/10.11646/zootaxa.4991.1.3